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Injury and Collision Losses By Engine Option Selected 1983 Models

Highway Loss Data Institute

Highway Loss Data Institute
Insurance Special Report

Injury and Collision Losses
By Engine Option
Selected 1983 Models

HLDI A-23

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SUMMARY

This report compares the collision and injury coverage loss results of eight 1983 model year vehicle series with standard equipment engines to the results for the same series with optional, more powerful engines. The vehicle series selected for this report are all mid-size or small passenger cars; at least one-third of the cars within each vehicle series have high performance engines. These cars are all two-door models and most are sports or specialty vehicles.

Principal Findings

- There was no consistent relationship between engine size and frequency of injury or collision claims. However, average loss payments per collision claim were substantially higher for cars equipped with more powerful engines than for those equipped with standard engines.

Personal Injury Protection Coverages

- Overall, the frequency of insurance *injury* claims did not correlate with engine size. Injury claim frequencies were higher for two of the series equipped with more powerful engines and they were lower for four such series compared to their counterparts equipped with standard engines. There was insufficient exposure to compare injury results for the other two vehicle series.

- The frequency of injury claims in which the medical payments exceeded $250 was lower for two of the series equipped with the more powerful engines, higher for one series, and showed no difference for one series compared to their versions equipped with standard engines. There was insufficient exposure to compute injury results for losses above $250 for the other four vehicle series.

Collision Coverages

- For *collision* coverages, six of the eight car series with more powerful engines had substantially higher average loss payments per insured vehicle year than those with standard engines. These increases ranged from 20 to 82 percent.

- For five of the eight car series, the cars with more powerful engines had substantially higher average loss payments per claim under collision coverages than their counterparts with standard engines.

- For both average loss payment per claim and average loss payment per insured vehicle year, the largest increases for the cars with the more powerful engines were for the five smallest vehicles.

- For six of the eight vehicle series, the collision coverage claim frequencies for cars with high performance engines were not substantially different from those with standard engines. The two exceptions were the V-8 engine equipped Mercury Capri, which had a claim frequency 37 percent higher than the four-cylinder engine version, and the V-8 engine equipped Ford Mustang, which had a 33 percent higher claim frequency than the four-cylinder engine version.

INTRODUCTION

The Highway Loss Data Institute (HLDI) is a nonprofit, public service organization that gathers, processes, and publishes insurance data concerning the human and economic losses associated with motor vehicles — especially the ways such losses vary among different kinds of vehicles.

In 1981, HLDI published a report on the relationships between insurance losses and engine specifications that was based on the injury and collision coverage results of 1977 through 1979 compact cars.[1] The report concluded that there were pronounced relationships between the collision coverage loss experience and engine size for specialty models. The cars with the most powerful engines had the worst loss experience. No consistent relationship was found for injury loss results and engine size. No consistent relationships were found between injury or collision results and engine size for regular two-door and four-door models.

This report compares collision and injury coverage loss results of high performance and less powerful standard engine versions of eight 1983 model cars. The selected 1983 cars used in this study were: the Chevrolet Camaro and Monte Carlo; Ford Mustang, Mustang Convertible, and Thunderbird; Pontiac Firebird and Grand Prix; and Mercury Capri. These 1983 cars were chosen because they are all midsize or small two-door vehicles, and because at least one-third of the cars within each vehicle series have factory installed, more powerful engines. Appendix A lists the vehicle series and their manufacturers' engine specifications.

The individual cars of each series were separated into two groups based on Vehicle Identification Numbers (VINs): those with standard equipment four- or six-cylinder (V-6) engines and those with optional high performance four-cylinder turbocharged or eight-cylinder (V-8) engines. The results in this report are based on the first two years of available personal injury protection and collision coverage data for the selected 1983 vehicle series. The data were supplied by eleven insurers: Aetna, Allstate, GEICO, Kemper, Liberty Mutual, Nationwide, Prudential, Safeco, State Farm, Travelers, and USAA.

RESULTS AND DISCUSSION

Personal Injury Protection Coverage Results. Table 1 (page 3) presents exposure (in insured vehicle years), overall injury claim frequency, and frequency of claims in which medical payments exceeded $250 for high performance engines and standard engines for each vehicle series.[2] The Mercury Capri and Ford Mustang Convertible did not have sufficient exposure to report overall injury claim frequency results. In four of the six comparisons for which there was sufficient exposure, the frequency of overall injury claims was *lower* for the cars with the more powerful engines. In the other two comparisons, the high performance models of both the Ford Mustang and Ford Thunderbird had *higher* overall injury claim frequencies.

For injury claims in which the medical payments exceeded $250, the frequency of injury was lower for the high performance models of both the Chevrolet Camaro and Monte Carlo. No difference was found between the claim frequencies for the high performance and standard V-6 equipped Ford Thunderbirds. The high performance Pontiac Grand Prix, however, had a higher injury claim frequency than its standard engine counterpart.

Collision Coverage Results. For each of the eight vehicle series, Table 2 (page 4) shows average loss payments per insured vehicle year under collision coverages and the percentage increase in this result for cars with high performance engines versus those with standard engines.[3] For the Pontiac Grand Prix and Chevrolet Monte Carlo, the average loss payments per insured vehicle year were about the same for the two versions. However, the comparisons for the six remaining series show that the average loss payments per insured vehicle year increased by between 20 percent (Ford Thunderbird) and 82 percent (Mercury Capri) for the cars with more powerful engines.

The cars with V-8 engines generally had higher average loss payments per claim (Table 3, page 5). For example, the Ford Mustang Convertible with the V-8 engine had a 37 percent higher average loss payment per claim than its four-cylinder counterpart. Similarly, the V-8 version of the Mercury Capri had a 34 percent higher average loss payment per claim than the four-cylinder version. For both average loss payment per claim and average loss payment per insured vehicle year, the largest percentage changes were associated with the five smallest vehicles. Because the injury claim frequencies were not consistently higher for models with more powerful engines, it is probable that their poorer collision coverage experience reflects the cost of other features associated with high performance models, such as special trim and paint options, rather than more severe crashes.

Table 4 (page 6) shows the collision coverage claim frequencies for each of the eight models. Most of the comparisons show very little difference in claim frequencies between models with the two types of engines. The exceptions were the two vehicle series with the largest difference in horsepower between the high performance and standard engine version; the claim frequency was 37 percent higher for the V-8 Mercury Capri and it was 33 percent higher for the V-8 Ford Mustang compared to the standard engine versions. Overall, the collision claim frequencies for the cars with the more powerful engines were not substantially different from the claim frequencies for standard engine versions.

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[1]See HLDI Research Report A-15.

[2]Injury results were standardized to eliminate effects due to operator age groups. See Appendix B for standardizing weights.

[3]Collision results were standardized to eliminate effects due to operator age groups and deductible amounts. See Appendix B for standardizing weights.

TABLE 1
Personal Injury Protection Coverage
Claim Frequencies By Engine Type
Selected 1983 Vehicles

Vehicle	Engine Version	Exposure	Overall Injury Claim Frequency*	Injury (>$250) Claim Frequency*
Mercury Capri	V-8	986		
	4 Cyl.	2853		
Ford Mustang	V-8	5683	29.7	
	4 Cyl.	12295	27.7	
Ford Mustang Convertible	V-8	1003		
	4 Cyl.	2842		
Chevrolet Camaro	V-8	17957	23.4	11.4
	V-6	15551	28.1	12.4
Pontiac Firebird	V-8	6085	20.1	
	V-6	8262	25.7	
Pontiac Grand Prix	V-8	8507	18.5	10.7
	V-6	13744	20.9	9.7
Chevrolet Monte Carlo	V-8	9411	19.9	10.1
	V-6	12484	22.6	11.7
Ford Thunderbird	V-8/4 Cyl. Turbo	7884	23.4	10.2
	V-6	14476	21.8	10.2

* Per 1,000 insured vehicle years of exposure
Blanks indicate insufficient exposure for calculating injury claim frequency result

TABLE 2
Collision Coverage
Average Loss Payments Per Insured Vehicle Year By Engine Type
Selected 1983 Vehicles

Vehicle	Engine Version	Exposure	Average Loss Payment Per Insured Vehicle Year	Percentage Change in Average Loss Payment Per Insured Vehicle Year*
Mercury Capri	V-8	2497	$301	+82%
	4 Cyl.	6413	165	
Ford Mustang	V-8	13871	307	+73
	4 Cyl.	28591	177	
Ford Mustang Convertible	V-8	2606	197	+44
	4 Cyl.	6943	137	
Chevrolet Camaro	V-8	41938	251	+26
	V-6	31407	200	
Pontiac Firebird	V-8	13862	256	+26
	V-6	15883	203	
Pontiac Grand Prix	V-8	19347	141	0
	V-6	26342	141	
Chevrolet Monte Carlo	V-8	22433	149	+3
	V-6	23313	145	
Ford Thunderbird	V-8/4 Cyl. Turbo	20484	200	+20
	V-6	31638	167	

* Percentage change in average loss payment per insured vehicle year for models with more powerful engines relative to their standard engine versions

TABLE 3
Collision Coverage
Average Loss Payments By Engine Type
Selected 1983 Vehicles

Vehicle	Engine Version	Exposure	Average Loss Payment Per Claim	Percentage Change in Average Loss Payment Per Claim*
Mercury Capri	V-8	2497	$2115	+34%
	4 Cyl.	6413	1584	
Ford Mustang	V-8	13871	2259	+30
	4 Cyl.	28591	1734	
Ford Mustang Convertible	V-8	2606	1989	+37
	4 Cyl.	6943	1447	
Chevrolet Camaro	V-8	41938	1865	+32
	V-6	31407	1416	
Pontiac Firebird	V-8	13862	1671	+20
	V-6	15883	1390	
Pontiac Grand Prix	V-8	19347	1395	−1
	V-6	26342	1416	
Chevrolet Monte Carlo	V-8	22433	1566	+4
	V-6	23313	1511	
Ford Thunderbird	V-8/4 Cyl. Turbo	20484	1658	+9
	V-6	31638	1527	

* Percentage change in average loss payment per claim for models with more powerful engines relative to their standard engine versions

TABLE 4
Collision Coverage
Claim Frequencies By Engine Type
Selected 1983 Vehicles

Vehicle	Engine Version	Exposure	Claim Frequency*	Percentage Change in Claim Frequency**
Mercury Capri	V-8	2497	14.2	+37 %
	4 Cyl.	6413	10.4	
Ford Mustang	V-8	13871	13.6	+33
	4 Cyl.	28591	10.2	
Ford Mustang Convertible	V-8	2606	9.9	+5
	4 Cyl.	6943	9.4	
Chevrolet Camaro	V-8	41938	13.5	−4
	V-6	31407	14.1	
Pontiac Firebird	V-8	13862	15.3	+5
	V-6	15883	14.6	
Pontiac Grand Prix	V-8	19347	10.1	+2
	V-6	26342	9.9	
Chevrolet Monte Carlo	V-8	22433	9.5	−1
	V-6	23313	9.6	
Ford Thunderbird	V-8/4 Cyl. Turbo	20484	12.1	+11
	V-6	31638	10.9	

* Per 100 insured vehicle years of exposure
** Percentage change in claim frequency for models with more powerful engines relative to their standard engine versions

APPENDIX A
Summary of Manufacturer's Engine Specifications For Selected 1983 Vehicles

Vehicle	Engine Type	Carburation	Displacement (Liters/Cubic Inch)	Net Horsepower at RPM
Mercury Capri	V-8	4 BBL[1]	5.0/302	175/4000
	4 Cyl.	1 BBL	2.3/140	90/4600
Ford Mustang	V-8	4 BBL	5.0/302	175/4000
	4 Cyl.	EFI[2]	2.3/140	90/4600
Ford Mustang Convertible	V-8	4 BBL	5.0/302	175/4000
	4 Cyl.	1 BBL	2.3/140	90/4600
Chevrolet Camaro	V-8	4 BBL	5.0/305	150/4000
	V-6	2 BBL	2.8/173	107/4800
Pontiac Firebird	V-8*	4 BBL	5.0/305	150/4000
	V-6	2 BBL	2.8/173	107/4800
Pontiac Grand Prix	V-8	4 BBL	5.0/305	150/4000
	V-6	2 BBL	3.8/231	110/3800
Chevrolet Monte Carlo	V-8	4 BBL	5.0/305	150/4000
	V-6	2 BBL	3.8/229	110/4000
Ford Thunderbird	V-8	4 BBL/CFI[3]	5.0/302	130/3200
	4 Cyl. Turbo	EFI	2.3/140	145/3800
	V-6	2 BBL	3.8/232	110/3800

* Includes the Pontiac Trans/AM
[1] BBL = Barrels
[2] EFI = Electronic Fuel Injection
[3] CFI = Central Fuel Injection

Source: Motor Vehicle Manufacturers Association, specifications from Ford Motor Company and General Motors Company

APPENDIX B Standardization

Insurance loss experience varies in relation to certain non-vehicle factors. With respect to Personal Injury Protection (PIP) coverages, one important factor that influences loss experience is operator age. Youthful operators generally have worse loss experience than older drivers. Thus, the proportions of youthful operators must be taken into consideration in comparing the loss experience of different vehicles.

To remove any biases that could result because of variations among different vehicles in an operator age group, the PIP coverage results for the vehicles in this study were weighted, or standardized, to produce a weighted average of actual results. The weights used in the standardization procedure are shown below.

Operator Age Group	Distribution
Youthful	.10
Nonyouthful	.90

With respect to collision coverages, both the frequency and average size of collision losses vary with the deductible

amount and the age group of the operators. Therefore, collision coverage results for the vehicles in this study were standardized using the weights shown below.

Deductible	Youthful Operator	Nonyouthful Operator
< $150	.05	.50
≥ $150	.05	.40

Standardizing these nonvehicle factors ensures that their mix is the same for each result. Therefore, to the extent that age distributions within each operator age group and amounts within each deductible group do not vary substantially for different vehicles, these effects will not bias comparisions among the various results.

The standarization procedure employed is widely used in health statistics.* The basic principle of the method is the introduction of a selected population with a standard distribution across operator age group, or across the combination of operator age group and deductible, as represented by the standardization weights in the tables.

APPENDIX C Definitions

Average Loss Payment per Claim — The total of all loss payments made for the claims for a group of vehicles, divided by the number of claims paid; expressed as dollars per claim.

Average Loss Payment per Insured Vehicle Year — For a group of vehicles, the product of Claim Frequency and Average Loss Payment per Claim, divided by 100; expressed as dollars per insured vehicle year. It should be noted that this definition differs from the commonly used insurance term, pure premium, but yields similar results.

Collision Claim Frequency — The number of claims for a group of vehicles, divided by the exposure for that group; expressed as claims per one hundred insured vehicle years.

Collision Coverages — As defined in insurance contracts, the coverage under which people insure their own vehicle against loss caused by collision.

Deductible Amount — That portion of the collision damage cost borne by the policyholder. For computing results, deductible amounts are split into two groups; less than $150 (mainly $50 and $100 deductibles) and greater than or equal to $150 (mainly $200 and $250 deductibles).

Exposure — The time interval an individual vehicle is insured. Exposure for a group of vehicles is expressed in units of insured vehicle years.

Personal Injury Protection (PIP) Claim Frequency — The number of claims for a group of vehicles, divided by the exposure for that group; expressed as claims per one thousand insured vehicle years.

Personal Injury Protection Coverage — First-party no-fault coverage in which an insurer pays, within the specified limits, the medical, hospital, and other expenses of the insured, others in his vehicle, and pedestrians struck by him.

Operator Age Group — The factor which distinguishes those vehicles whose rated driver is youthful from those vehicles whose rated driver is not youthful (see Youthful Operator).

Rated Driver — The driver who, for insurance purposes, is considered to represent the greatest loss potential for the insured vehicle.

Vehicle Size Class — There are four major body style groupings of passenger vehicles — regular two-door models, regular four-door models, station wagons and passenger vans, and sports and specialty models. Sports and specialty models include all two-seater cars, all convertibles, all midsize and large cars with two or fewer designated rear seating positions, and all luxury cars. All vehicles are divided into size classes based on wheelbase (rounded to nearest inch) defined as follows:

Small — Vehicles with wheelbases less than or equal to 99 inches.

Midsize — Vehicles with wheelbases greater than 99 inches and less than or equal to 109 inches.

Large — Vehicles with wheelbases greater than 109 inches.

Vehicle Identification Number (VIN) — A code, variously comprising both numbers and letters; normally, 8 to 17 characters in length, assigned to each vehicle by its manufacturer. The VIN uniquely identifies the vehicle within at least a ten-year span and, in recent model year vehicles, contains coding which identifies the make, series, model year, and other characteristics of each vehicle.

Vehicle Series — A name denoting a family of vehicles, within a make, with the same wheelbase and a degree of commonality in construction such as body, chassis, etc.

Youthful Operator — For the purposes of this report, all males (married or single) under 25 years of age and all unmarried females under 25 years of age.

*For example, see Armitage, P. *Statistical Methods in Medical Research*, Wiley, New York (1971).

HLDI Publications

Research reports published by the Highway Loss Data Institute are:

R72-1 *Automobile Insurance Losses, Collision Coverages; Variations by Make and Series, 1972 Models,* June 1973.

R73-1 *Automobile Insurance Losses, Collision Coverages; Initial Results for 1973 Models Compared with 1972 Models,* September 1973.

R73-2 *Automobile Insurance Losses, Collision Coverages; Variations by Make and Series, 1973 Models,* March 1974.

R73-3 *Automobile Insurance Losses, Collision Coverages; Variations by Make and Series, 1973 Models During Their First Two years,* December 1974.

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R74-1 *Automobile Insurance Losses, Collision Coverages; Initial Results for 1974 Models,* May 1974.

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R78-2 *Automobile Insurance Losses, Collision Coverages; Variations by Make and Series, 1978 Models During Their First Year, 1977 Models During Their First Two Years, 1976 Models During Their First Three Years,* January 1979.

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R81-2 *Insurance Losses, Collision Coverages; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1981 Models During Their First Year, 1980 Models During Their First Two Years, 1979 Models During Their First Three Years,* December 1981.

R82-1 *Automobile Insurance Losses, Collision Coverages; Initial Results for 1982 Models,* July 1982.

R82-2 *Insurance Losses, Collision Coverages; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1982 Models During Their First Year, 1981 Models During Their First Two Years; 1980 Models During Their First Three Years,* December 1982.

R83-1 *Automobile Insurance Losses, Collision Coverages; Initial Results for 1983 Models,* June 1983.

R83-2 *Insurance Losses, Collision Coverages; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1983 Models During Their First Year, 1982 Models During Their First Two Years, 1981 Models During Their First Three Years,* January 1984.

R84-1 *Automobile Insurance Losses, Collision Coverages; Initial Results for 1984 Models,* June 1984.

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V80-1 *Automobile Insurance Losses, Non-Commercial Collision Coverages; Variations by Make and Series, Vans, Pickups, and Utility Vehicles; 1980 Models During Their First Year, 1979 Models During Their First Two Years, 1978 Models During Their First Three Years,* December 1980.

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A-7 *Automobile Insurance Losses, Collision Coverages; Annual Increases and Seasonal Variations 1972, 1973, 1974 and 1975 Models,* June 1976.

A-8 *Automobile Insurance Losses, Injury Coverages; A Preliminary Comparison of Results for Volkswagen Rabbits with Passive and Active Seat Belts, 1975 and 1976 Models,* June 1977.

A-9 *Automobile Insurance Losses, Collision Coverages; A Comparison of Collision Claim Size Distributions for 1974, 1975, and 1976 Models,* November 1977.

A-10 *Automobile Insurance Losses, Injury Coverages; Comparisons of Claim Frequencies of Volkswagen Rabbits with Automatic and Manual Seat Belts, 1975, 1976, and 1977 Models,* June 1979.

A-11 *Automobile Insurance Losses, Collision Coverages; The Consistency of the Loss Experience of Specific Vehicles Produced in Several Years, 1975 to 1978 Models,* June 1979.

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A-14 *Automobile Insurance Losses, Personal Injury Protection and Collision Coverages; Comparisons of the Loss Experience of Two- and Four-Door Cars, 1978, 1979, and 1980 Models,* June 1981.

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A-16 *Automobile Insurance Losses, Collision Coverages; The Frequency of Claims Involving Salvage; Subcompact and Compact Cars; 1980 Models,* January 1982.

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A-19 *Insurance Losses, Theft Coverages; A Comparison of the Theft Loss Experience of General Motors Passenger Cars With and Without Factory-Installed Theft Deterrent Systems; 1980-1981 Models,* January 1983.

A-20 *Insurance Losses, Collision Coverages, A Comparison of the Collision Loss Experience of Subaru Models with 5 and 2.5 MPH Bumpers,* April 1983.

A-21 *Insurance Losses, Personal Injury Protection Coverages, Injury Claim Frequencies for Volkswagen Rabbits with Automatic and Manual Seat Belts, 1981 and 1982 Models,* April 1984.

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Comparison of the Insurance Loss Experience Of Unibody and Frame Construction Cars After a Collision Repair, 1981-82 Models

Highway Loss Data Institute

Highway Loss Data Institute
Insurance Special Report

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HLDI A-24

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SUMMARY

This report compares the collision coverage loss experience of unibody and frame construction cars following a collision repair. The study was undertaken because concerns have been expressed that improper repairs of unibody cars have become common and, as a consequence, these cars are more likely to be involved in collisions following repairs. The study is based on the collision coverage loss results for 35 popular 1981 and 1982 passenger cars during their first three years of availability. Principal findings include the following:

- Collision coverage results for repaired 1981 and 1982 unibody models were no worse than the results for repaired 1981 and 1982 frame construction models.
- Comparisons of collision coverage results for unibody and frame construction vehicles showed no difference when grouped by the cost of the initial repair.

INTRODUCTION

The number of small cars in the U.S. automobile fleet has been growing substantially for several years. Traditional, large American made cars are built on frames, but for all recently built small cars, the body shell itself replaces the separate frame. This construction method is generally termed "unibody" construction. Although unibody construction is not new, there have recently been allegations that unibody cars are being improperly repaired in ways that could result in their being unsafe for subsequent use. These allegations center on the complexities involved in straightening and realigning a damaged unibody car. Many unibody cars incorporate a front-end suspension system that has very limited adjustment available to produce correct alignment. Consequently, it is important that a damaged car body be returned as closely as possible to its original dimensions in order to be able to correctly align the front-end suspension system. If a repaired car is improperly aligned, it may not steer and handle correctly, and this in turn could increase the chances that it would be involved in subsequent collisions. Concerns have been expressed that improper alignment of damaged unibody cars has become common and that these cars are unsafe.

The HLDI data provide the capability of examining the crash experience of cars after they have been repaired because of involvement in a prior collision. Using collision coverage claims data, it is possible to compare the experience of unibody and frame cars subsequent to collision and repair to see if their post-crash experience is different. However, there are still limitations in interpreting such comparisons because unibody and frame cars are of different sizes, and there is virtually no size overlap between the two types of cars. This complicates *any* comparison of unibody and frame cars because car size per se has been repeatedly shown to be a significant factor in insurance loss experience.

METHOD OF ANALYSIS

This study is based on the collision coverage loss experience of 35 popular 1981 and 1982 passenger cars.[1] The results were grouped by vehicle size (small, midsize, and large), body style (two-door, four-door, and sports and specialty), and type of construction (unibody and frame). The results were based on the collision coverage experience for the first three years of availability of the model years studied.

The unibody cars examined in this report are all small or midsize and frame cars are either midsize or large. Although the midsize group ot cars contains both unibody and frame cars, the unibody cars in this size class are smaller than the frame cars. Previous HLDI analyses have shown that small cars tend to have poor collision loss results and large cars tend to have better results. Because of the relation of size to collision losses, comparisons of results for the two construction types must be interpreted with caution.

Two sets of results were compiled for each of the two groups of cars: the collision loss experience for all cars and the loss experience for the subsets of cars that previously had a collision claim. This permits comparisons of the claim frequencies for repaired cars (i.e., cars with a previous collision claim) with the claim frequencies for the same type of cars without regard to whether they had had a previous claim. The following hypothetical example illustrates how these results can be used to examine this issue: Suppose that the claim frequency results for a group of repaired unibody and repaired frame vehicles were 15 and 10 (claims per 100 insured vehicle years of exposure), respectively. These hypothetical results show a 50 percent difference between the claim frequency for repaired unibody cars compared to frame cars; however, this difference may be simply because unibody cars are smaller than frame cars. Next suppose that claim frequencies were computed for *all* unibody and frame cars regardless of whether or not they had had a previous claim, and that these were 12 and 8 (claims per 100 insured vehicle years of exposure), respectively. These hypothetical results also show a 50 percent difference in claim frequencies; however, this may be due to size rather than construction type. The size effect can be removed by comparing the *increases* in claim frequencies for the repaired cars with the overall frequencies. In this hypothetical example, the increase in claim frequencies of repaired unibody compared to all unibody cars is 25 percent (15 versus 12). The increase is also 25 percent for frame cars (10 versus 8) suggesting, in this example, that any effect due to the prior repair was not different for the two construction types.

RESULTS AND DISCUSSION

Table 1 presents collision claim frequency results for those individual vehicle series with more than 1,000 insured vehicle years of exposure subsequent to their initial collision claim. The table shows the overall standardized claim frequency results for all cars and the percentage increases in standardized claim frequency results for those cars that were involved in a collision claim.[2] For the latter cars the results are based on the experience of the cars *after* their initial claim. This subsequent exposure was not computed until 30 days after the initial crash date to allow time for the required repairs to be completed.

The table provides the number of insured vehicle years of exposure for repaired cars only (i.e., cars with at least one prior claim) and combined claim frequency for 1981 and 1982 model year vehicles as reported in HLDI reports R83-2 and R84-2. Thus, these combined claim frequencies are based on the exposure for all vehicles (i.e., repaired vehicles

[1]See Appendix A for a list of the selected vehicle series.

[2]Results were standardized to eliminate effects due to operator age groups and deductible amounts. See Appendix B for standardizing weights.

plus those with no collision claim losses). The final three columns of Table 1 present percentage increases in collision claim frequencies for the repaired cars over the claim frequencies for all cars as a function of the cost of the initial repair. The cars that have been in a prior crash have a higher risk of subsequent claims experience than the overall experience for the same cars. The percentage increase in claim frequencies is given for all cars with at least one prior claim regardless of the amount, for repair claims greater than $500, and for repair claims greater than $1,000. Because there are fewer large claims, the amount of exposure decreases as the repair size category increases. The cost of the initial repair was obtained by adding the collision deductible to the paid claim amount.

Table 2 displays the results obtained after aggregating the results from the 35 individual vehicle series within combinations of type of construction, body style, and vehicle size. The results in Tables 1 and 2 do not indicate that the experience of unibody cars subsequent to a crash is any worse than that of frame cars. Taking into account all initial claims, Table 2 shows that the increases for unibody cars ranged from 20 to 60 percent and those for frame cars from 36 to 40 percent. Results based on the magnitude of original repairs yield similar conclusions — repaired unibody cars do not have relatively higher collision claim frequencies than repaired frame cars.

Figure 1 compares the increases in collision coverage claim frequencies for repaired, two-door unibody and frame cars based on the size of the original repair. The range of the average relative increase (1.0 standard deviation) is also presented to illustrate the variability of the individual vehicles' results when combining across vehicle size class. Figure 1 also shows that there are not significant differences in the increases in collision coverage claim frequencies for two-door unibody and frame cars that have been insured following a collision claim.

Figures 2 and 3 present similar comparisons for four-door and sports and specialty models and yield identical conclusions.

The results of this study provide no support for the hypothesis that repaired unibody cars are more likely to be involved in crashes than repaired frame cars.

TABLE 1
Increases in Collision Coverage Claim Frequencies For 1981-82 Model Year Cars After a Collision Repair

Body Style & Construction Type	Make/Series	Exposure For Repaired Cars	Claim Frequency For All Cars*	Percentage Increases In Claim Frequency For Repaired Cars		
				Size of Initial Repair		
				All	> $500	> $1000
TWO-DOOR						
Unibody	Chevrolet Chevette	2033	8.5	31	27	16
	Ford Escort	2464	8.2	33	28	2
	Ford Mustang	2372	9.2	10	7	4
	Honda Civic	1524	9.2	50	48	40
	Toyota Celica	2069	11.3	29	27	12
	Toyota Corolla	2547	11.3	27	19	19
Frame	Buick Regal	1770	8.5	34	34	19
	Oldsmobile Cutlass	2376	8.9	42	52	42
FOUR-DOOR						
Unibody	Chevrolet Chevette	2436	8.0	59	51	45
	Chevrolet Citation	1451	7.4	91	76	45
	Honda Accord	1135	8.6	14	31	-17
SPORTS & SPECIALTY						
Unibody	Chevrolet Camaro	2945	12.1	25	16	9
	Pontiac Firebird	1433	12.3	35	27	4
Frame	Chevrolet Monte Carlo	1514	8.8	33	33	35
	Pontiac Grand Prix	1258	9.0	39	31	21

* Results are taken from HLDI Reports R83-2 and R84-2 for model years 1981 and 1982, respectively.

TABLE 2
Increases in Collision Coverage Claim Frequencies
By Vehicle Size Class and Body Style
For 1981-82 Model Year Cars After a Collision Repair

Body Style & Construction Type	Vehicle Size Class	Exposure For Repaired Cars	Claim Frequency For All Cars*	Percentage Increases In Claim Frequency For Repaired Cars		
				Size of Initial Repair		
				All	> $500	> $1000
TWO-DOOR						
Unibody	Small	13713	9.9	32	25	20
	Midsize	3614	9.0	20	13	13
Frame	Midsize	4146	8.7	39	45	32
FOUR-DOOR						
Unibody	Small	5913	8.2	52	48	34
	Midsize	3408	7.9	60	49	41
Frame	Midsize	1401	7.3	40	45	67
SPORTS & SPECIALTY						
Unibody	Midsize	4378	12.2	27	19	7
Frame	Midsize	2772	8.9	36	31	28

* These results are derived from HLDI Reports R83-2 and R84-2 for model years 1981 and 1982, respectively.

FIGURE 1
Increases in Collision Coverage Claim Frequencies
After a Collision Repair — Unibody vs. Frame
1981-82 Two-Door Models

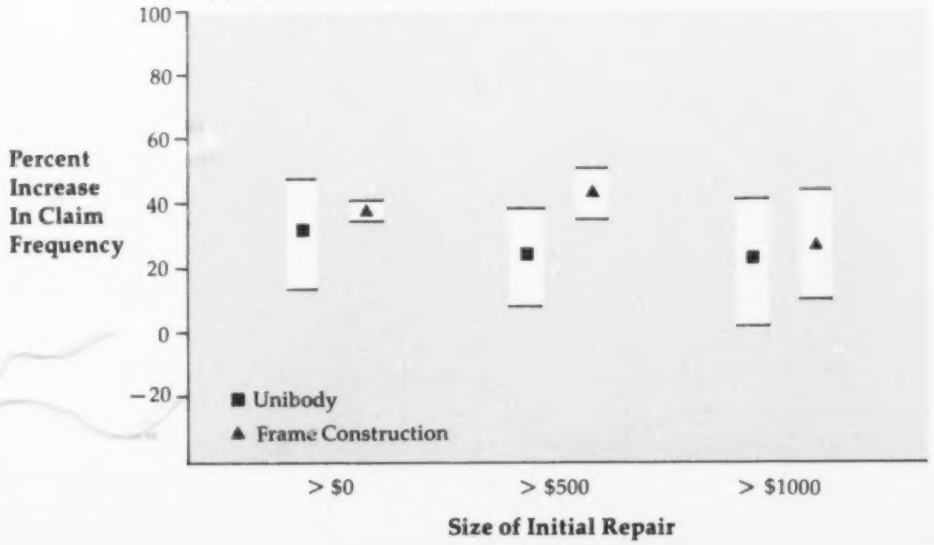


FIGURE 2
Increases in Collision Coverage Claim Frequencies After a Collision Repair — Unibody vs. Frame 1981-82 Four-Door Models

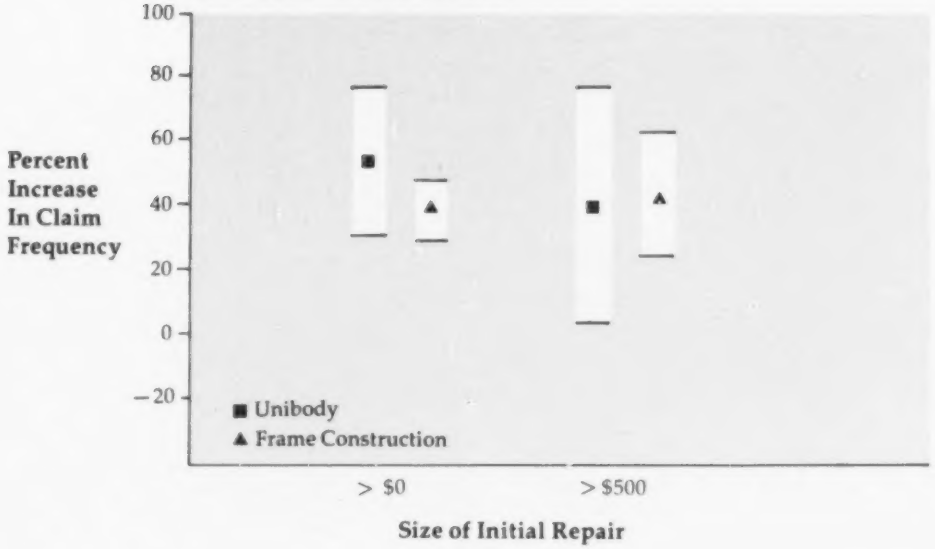
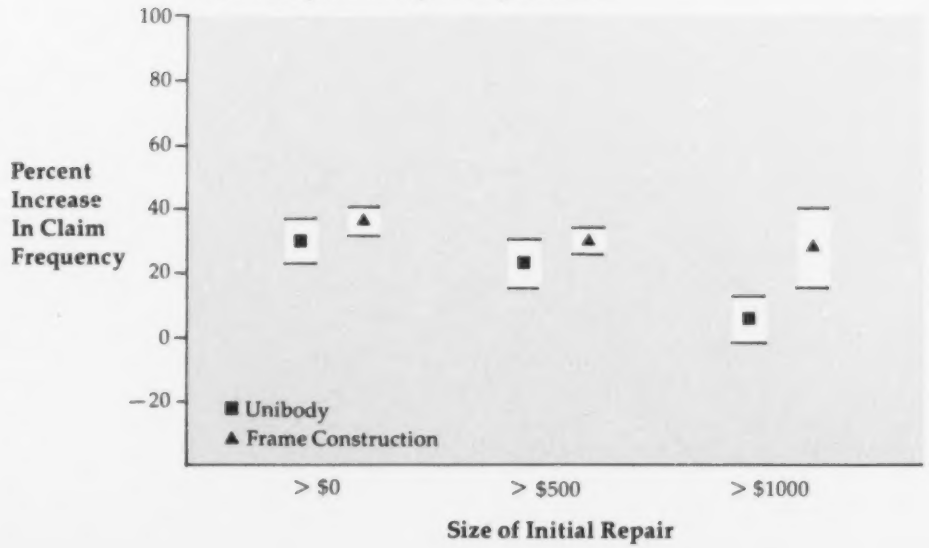


FIGURE 3
Increases in Collision Coverage Claim Frequencies After a Collision Repair — Unibody vs. Frame 1981-82 Sports & Specialty Models



APPENDIX A Selected 1981-82 Vehicles

Body Style & Construction Type	Vehicle Size Class	Vehicle Series	Model Year(s)
TWO-DOOR			
Unibody	Small	Chevrolet Chevette	1981, 1982
		Datsun 200SX	1982
		Datsun 210	1981
		Ford Escort	1981, 1982
		Honda Accord	1981, 1982
		Honda Civic	1981, 1982
		Toyota Celica	1981, 1982
		Toyota Corolla	1981, 1982
		Toyota Corolla Tercel	1982
	Midsize	Chevrolet Cavalier	1982
		Chevrolet Citation	1981
		Ford Mustang	1981, 1982
Frame	Midsize	Buick Regal	1981, 1982
		Oldsmobile Cutlass	1981, 1982
FOUR-DOOR			
Unibody	Small	Chevrolet Chevette	1981, 1982
		Ford Escort	1982
		Honda Accord	1981, 1982
		Plymouth Horizon	1981
		Toyota Corolla Tercel	1982
		Volkswagen Rabbit	1981, 1982
	Midsize	Buick Century	1982
		Buick Skylark	1981, 1982
		Chevrolet Cavalier	1982
		Chevrolet Celebrity	1982
		Chevrolet Citation	1981, 1982
		Oldsmobile Ciera	1982
Frame	Midsize	Buick Century	1981
		Chevrolet Malibu	1981
		Oldsmobile Cutlass	1981, 1982
	Large	Oldsmobile Delta 88	1981, 1982
		Oldsmobile Ninety Eight	1982
SPORTS & SPECIALTY			
Unibody	Midsize	Chevrolet Camaro	1981, 1982
		Pontiac Firebird	1981, 1982
Frame	Midsize	Chevrolet Monte Carlo	1981, 1982
		Pontiac Grand Prix	1981, 1982

APPENDIX B Standardization

Insurance loss experience varies with certain nonvehicle factors. With respect to collision coverages, two such important factors are the deductible amount of the coverage and the operator age group. In the case of operator age group, youthful operators generally generate higher insurance losses than older drivers. Thus, the proportions of youthful operators must be taken into consideration in comparing the loss experience of different vehicles. Results obtained from the two deductible categories, less than $150 and greater than or equal to $150, also vary. Again, if compared vehicles have different proportions of lower deductible coverages, this difference, if not taken into consideration, would also be sufficient to bias the comparison.

To remove any biases that could result because of variations among different vehicles in deductible amount and operator age group, the collision coverage results for the vehicles in this study were adjusted, or standardized, to produce a weighted average of actual results. The weights used in the standardization procedure are shown to the right.

Deductible	Youthful Operator	Nonyouthful Operator
< $150	.05	.50
≥ $150	.05	.40

Standardizing for these nonvehicle factors ensures that their mix is the same for each result. Therefore, to the extent that age distributions within each operator age group and amounts within each deductible group do not vary substantially for different vehicles, these effects will not bias comparisons among the various results.

The standarization procedure employed is widely used in health statistics.* The basic principle of the method is the introduction of a selected population with a standard distribution across the combinations of operator age group and deductible amounts, as represented by the standardization weights in the above table.

APPENDIX C Definitions

Claim Frequency — The number of claims for a group of vehicles, divided by the exposure for that group; expressed as claims per one hundred insured vehicle years.

Collision Coverages — As defined in insurance contracts, the coverage under which people insure their own vehicle against loss caused by collision.

Deductible Amount — That portion of the collision damage cost borne by the policyholder. For computing results, deductible amounts are split into two groups; less than $150 (mainly $50 and $100 deductibles) and greater than or equal to $150 (mainly $200 and $250 deductibles).

Exposure — The time interval an individual vehicle is insured. Exposure for a group of vehicles is expressed in units of insured vehicle years.

Loss Payment — That portion of the collision damage cost borne by the insurer; in general, the total collision damage cost minus the deductible amount.

Operator Age Group — The factor which distinguishes those vehicles whose rated driver is youthful from those vehicles whose rated driver is not youthful (see Youthful Operator).

Rated Driver — The driver who, for insurance purposes, is considered to represent the greatest loss potential for the insured vehicle.

Vehicle Size Class — There are four major body style groupings of passenger vehicles — regular two-door models, regular four-door models, station wagons and passenger vans, and sports and specialty models. Sports and specialty models include all two-seater cars, all convertibles, all midsize and large cars with two or fewer designated rear seating positions, and all luxury cars. All vehicles are divided into size classes based on wheelbase (rounded to nearest inch) defined as follows:

Small — Vehicles with wheelbases less than or equal to 99 inches.

Midsize — Vehicles with wheelbases greater than 99 inches and less than or equal to 109 inches.

Large — Vehicles with wheelbases greater than 109 inches.

Vehicle Identification Number (VIN) — A code, variously comprising both numbers and letters; normally, 8 to 17 characters in length, assigned to each vehicle by its manufacturer. The VIN uniquely identifies the vehicle within at least a ten-year span and, in recent model year vehicles, contains coding which identifies the make, series, model year, and other characteristics of each vehicle.

Vehicle Series — A name denoting a family of vehicles, within a make, with the same wheelbase and a degree of commonality in construction such as body, chassis, etc.

Youthful Operator — For the purposes of this report, all males (married or single) under 25 years of age and all unmarried females under 25 years of age.

*For example, see Armitage, P. *Statistical Methods in Medical Research*, Wiley, New York (1971).

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A-14 *Automobile Insurance Losses, Personal Injury Protection and Collision Coverages; Comparisons of the Loss Experience of Two- and Four-Door Cars, 1978, 1979, and 1980 Models,* June 1981.

A-15 *Automobile Insurance Losses, Personal Injury Protection and Collision Coverages; Relationships Between Injury and Collision Losses and Engine Options for Selected 1977-1979 Compact Cars,* June 1981.

A-16 *Automobile Insurance Losses, Collision Coverages; The Frequency of Claims Involving Salvage; Subcompact and Compact Cars; 1980 Models,* January 1982.

A-17 *Insurance Losses, Comprehensive Coverages; Non-Crash Fire Losses; 1979-1980 Models,* February 1982.

A-18 *Insurance Losses, Theft Coverages; The Distribution of Theft Loss Payment Amounts; Passenger Cars, Vans Pickups, and Utility Vehicles; 1981 Models During Their First Year, 1980 Models During Their First Two Years; 1979 Models During Their First Three Years,* June 1982.

A-19 *Insurance Losses, Theft Coverages; A Comparison of the Theft Loss Experience of General Motors Passenger Cars With and Without Factory-Installed Theft Deterrent Systems; 1980-1981 Models,* January 1983.

A-20 *Insurance Losses, Collision Coverages, A Comparison of the Collision Loss Experience of Subaru Models with 5 and 2.5 MPH Bumpers,* April 1983.

A-21 *Insurance Losses, Personal Injury Protection Coverages, Injury Claim Frequencies for Volkswagen Rabbits with Automatic and Manual Seat Belts, 1981 and 1982 Models,* April 1984.

A-22 *Insurance Losses, Collision Coverages, An Analysis of Salvage Credits, 1977 Through 1982 Model Year Cars,* July 1984.

A-23 *Injury and Collision Losses by Engine Option, Selected 1983 Models*, October 1985.

A-24 *Comparison of the Insurance Loss Experience of Unibody and Frame Construction Cars After a Collision Repair, 1981-82 Models*, October 1985.

T79-1 *Automobile Insurance Theft Losses by Make and Series; 1979 Models*, June 1980.

T80-1 *Automobile Insurance Theft Losses by Make and Series; 1979 and 1980 Models*, April 1981.

T81-1 *Insurance Losses, Theft Coverages; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1981 Models During Their First Year, 1980 Models During Their First Two Years, 1979 Models During Their First Three Years*, May 1982.

T82-1 *Insurance Losses, Theft Coverages; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1982 Models During Their First Year, 1981 Models During Their First Two Years, 1980 Models During Their First Three Years*, May 1983.

T83-1 *Insurance Losses, Theft Coverages; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1983 Models During Their First Year, 1982 Models During Their First Two Years, 1981 Models During Their First Three Years*, May 1984.

T84-1 *Insurance Losses, Theft Coverages; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1984 Models During Their First Year, 1983 Models During Their First Two Years, 1982 Models During Their First Three Years*, March 1985.

Relationships Between Losses and Vehicle Density 1982-84 Models

Highway Loss Data Institute

Highway Loss Data Institute
Insurance Special Report

Relationships Between Losses And Vehicle Density 1982-84 Models

HLDI A-25

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SUMMARY

This Highway Loss Data Institute (HLDI) study illustrates the influence of vehicle density (measured as number of registered cars per square mile) on insurance collision losses and on first-party medical losses in no-fault states. This report summarizes the frequency and severity of collision and injury claims for five categories of increasing vehicle density. Results, based on the collision experience of 1982 models and the injury experience of 1982-84 models, are presented for passenger cars (small, midsize, and large), vans, small and standard pickups, and small and intermediate utility vehicles.

Personal Injury Protection Coverages

- The frequency of all injury claims and the frequency of claims with medical losses of more than $1,000 increased as vehicle density increased from low to high for each of the three passenger car size groups (Figure 1, page 5; Figure 4, page 8).
- The patterns of injury losses by vehicle density were not consistent for pickups, vans, and utility vehicles. The frequency of all injury claims increased with increasing vehicle density for small pickups; they exhibited no pronounced relationships for standard pickups, vans, and intermediate vehicles; and for small utility vehicles, they decreased with increasing density (Figure 2, page 6).

Collision Coverages

- As vehicle density increased from low to high, collision claim frequencies for passenger cars increased for each car size group (Figure 7, page 11).
- Among vans, pickups, and utility vehicles, collision coverage claim frequencies increased with increasing vehicle density, except for small utility vehicles, which had a relatively higher claim frequency in the lowest density category (Figure 8, page 12).
- In general, the average loss payment per claim remained constant as vehicle density increased. The exception was small utility vehicles, which had decreasing average loss payments per claim with increasing vehicle density. Vans had consistently lower average loss payments per claim within each of the vehicle density categories (Figure 10, page 14; Figure 11, page 15).
- The average loss payment per insured vehicle year remained relatively constant for all vehicle densities for vans, small and standard pickups, and intermediate utility vehicles; it increased with increasing vehicle density for passenger cars; and it decreased with increasing vehicle density for small utility vehicles (Figure 13, page 17; Figure 14, page 18).

INTRODUCTION

The Highway Loss Data Institute (HLDI) is a nonprofit, public service organization that gathers, processes, and publishes insurance data concerning the human and economic losses associated with motor vehicles — especially the ways such losses vary among different kinds of vehicles.

Previous HLDI reports (A-2 and A-4) on the relationship of collision coverage losses to vehicle density (the number of registered cars per square mile) concluded that vehicles garaged in high density areas generally produced more frequent collision claims, but with lower average loss payments per claim, than vehicles garaged in low density areas. Those studies also concluded that the influence of vehicle density on the frequency and size of collision claims was consistent for each of the four car size classes (subcompact, compact, intermediate, and full size) considered at that time.

This report examines the effect of vehicle density on the collision experience of 1982 models and the injury experience of 1982-84 models. Results are presented for passenger cars (small, midsize, and large), vans, small and standard pickups, and small and intermediate utility vehicles.

The results in this report are based on personal injury protection and collision coverage loss data supplied by nine insurers: Aetna, Allstate, Fireman's Fund, GEICO, Liberty Mutual, Prudential, Sentry, State Farm, and Travelers.

METHOD OF DATA ANALYSIS

Vehicle density, measured as the number of registered passenger cars per square mile, was determined for every county and independent city in the United States.[1] Five categories of increasing vehicle density were defined for use in this report with approximately 20 percent of the total number of registered passenger cars in each category. Each vehicle in the HLDI data base was assigned to one of the five groups by matching the zip code of the vehicle's garaging location with its appropriate county or independent city. The density categories and examples of counties from each category are given in Table 1.

TABLE 1
Definitions and Examples of Vehicle Density Categories

Density Category	Cars Per Square Mile		Example County
	> Lower Limit	≤ Upper Limit	
1 (Low)	0	41	Billings County, ND Huntington County, PA
2	41	144	Nantucket County, MA Schuylkill County, PA
3	144	429	New London County, CT Schenectady County, NY
4	429	984	Providence County, RI Sacramento County, CA
5 (High)	984	—	Los Angeles County, CA Queens County, NY

[1] An independent city is defined as a city that is not contained within a county. The registered passenger car information, based on the 1980 Census data, and land area information, were obtained from Rand McNally-Infomap, Inc., Chicago, Illinois.

RESULTS AND DISCUSSION

Personal Injury Protection Coverage Results

The frequency of all injury claims increased as vehicle density increased from low to high. As shown in Figure 1 (page 5), the increases in overall injury claim frequency as vehicle density increased were consistent for each passenger car size group.[2] For all injury claims for pickups, vans, and utility vehicles, the patterns of injury losses by vehicle density were not consistent (Figure 2, page 6). Injury claim frequencies for small pickups were similar to those for passenger cars; they showed no pattern of relationship to vehicle density for standard pickups, vans, and intermediate utility vehicles; and they decreased for small utility vehicles with increasing density. Two-door, four-door, station wagon, and sports and specialty passenger cars had similarly increasing overall injury claim frequencies as vehicle density increased (Figure 3, page 7). The two-door cars showed consistently higher claim frequencies across all of the density categories.

Figures 4 through 6 (pages 8-10) present claim frequencies for severe injury (claims in which the medical payments exceeded $1,000).[3] In general, severe injury claim frequencies increased as vehicle density increased. For all three sizes of passenger cars, the patterns of severe injury claim frequencies were consistent; within each density category, the smaller the car, the higher the frequency of severe injury (Figure 4). The pattern of results was similar for small pickups and passenger cars (Figure 5). Vans and standard pickups showed similar trends in the frequency of severe injuries across the density categories. Four-door passenger cars, station wagons and sports and specialty models had similar frequencies of severe injury in the two lowest density categories (Figure 6). However, as vehicle density increased in the three highest categories, station wagons had consistently lower injury claim frequencies. Two-door passenger cars had the highest frequencies of severe injury within each of the density categories.

Collision Coverage Results

Figures 7 through 9 (pages 11-13) present collision coverage claim frequencies for the five vehicle density categories for all passenger cars, vans, small and intermediate utility vehicles, and small and standard pickups.[4] In general, the collision claim frequencies increased as vehicle density increased. Figure 7 shows increasing collision claim frequencies, regardless of car size, as vehicle density increases. For each vehicle density category, claim frequencies were highest for small cars and decreased with car size. Collision claim frequencies increased with vehicle density for all cars and small pickups (Figure 8). They also increased for vans, standard pickups, and small and intermediate utility vehicles, but the increases were not pronounced. Small utility vehicles had an unusually high frequency of collision claims in the lowest density category compared to the claim frequency for this group of vehicles in the second lowest density category. Claim frequencies for each of the passenger car body styles increased with vehicle density (Figure 9).

As shown in Figure 10 (page 14), no relationship between average loss payment per claim and vehicle density was found for passenger car size. For small utility vehicles, average loss payment per claim decreased with increasing vehicle density (Figure 11, page 15). In addition, this decrease was the largest change among the six vehicle types in relation to density. Average loss payment per claim for vans was the lowest among the six vehicle types. Results for vans were constant for the two lowest and two highest density categories but decreased in the middle category. There was no relationship between average loss payment per claim and vehicle density for all cars, small and standard pickups, and intermediate utility vehicles. None of the passenger car results for average loss payment per claim showed a relationship with vehicle density and body style (Figure 12, page 16). Results for the sports and specialty vehicles were consistently higher than the two-door, four-door, and station wagon results within each density category.

Figures 13 through 15 (pages 17-19) present average loss payment per insured year of exposure. The average loss payment per insured vehicle year increased as vehicle density increased for all car size groups (Figure 13). Within each density category, average loss payments per insured vehicle year were greatest for small cars, followed by midsize and large cars, respectively. In Figure 14, average loss payments per insured vehicle year for all passenger cars increased with vehicle density. For vans, the average loss payment per insured vehicle year was consistently lower within each of the five density groups. Small utility vehicle results decreased with increasing vehicle density. The results for the other vehicle types showed no relationship with vehicle density.

For small utility vehicles, injury claim frequencies (Figure 2), collision claim frequencies (Figure 8), average loss payment per claim (Figure 11), and average loss payment per

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[2] Injury results were standardized to eliminate effects due to operator age groups. See Appendix A for standardizing weights.

[3] Utility vehicles were not reported because the required 25,000 years of exposure necessary for reporting severe injury results were not available.

[4] Collision results were standardized to eliminate effects due to operator age groups and deductible amounts. See Appendix A for standardizing weights.

insured vehicle year (Figure 14) tend to be high in the lowest density category. These higher results in the low density categories may be the result of increased off-road use for many of these vehicles.

Sports and specialty models had substantially higher average loss payments per insured vehicle year within each density category compared to the other three body styles (Figure 15). Average loss payments per insured vehicle year increased for regular two-door, four-door, and sports and specialty models with increasing vehicle density for the three highest density groups. Station wagons had higher average loss payments per insured vehicle year in the second highest density category than in any of the other categories. The results for all four body styles showed no relationship with vehicle density for the three lowest density categories.

Because collision and injury coverage results are given by body style, as well as vehicle size, Table 2 gives the percentage of HLDI's 1982 collision exposure for the five density categories for each vehicle type. As expected, a large proportion (45-60 percent) of the exposure for pickups and utility vehicles is in the two lowest density categories. Similarly, passenger cars and vans have a substantial proportion (42-51 percent) of their exposure in the two highest density groups.

Table 3 shows the percentage distribution of collision coverage exposure by density category and vehicle size class for 1982 passenger cars. Across the three size classes, approximately 70 percent of the exposure was found in the three higher density categories. In addition, the three size classes had similar exposure distibutions over the density categories.

TABLE 2
Percentage Distribution of Collision Coverage Exposure By Density Category and Vehicle Type for 1982 Models

Vehicle Type	Density Category				
	1 (Low)	2	3	4	5 (High)
Two-door Passenger Car	13	18	21	23	25
Four-door Passenger Car	16	19	21	21	23
Station Wagon	16	20	22	21	21
Sports & Specialty	12	17	20	25	26
Vans	16	20	21	22	21
Small Pickups	24	25	21	17	13
Standard Pickups	35	25	17	15	8
Small Utility Vehicles	22	23	21	18	16
Intermediate Utility Vehicles	27	21	19	19	14

TABLE 3
Percentage Distribution of Collision Coverage Exposure By Density Category and Vehicle Size Class for 1982 Passenger Cars

Vehicle Size Class	Density Category				
	1 (Low)	2	3	4	5 (High)
Small	12	18	22	23	25
Midsize	14	19	21	23	23
Large	18	18	19	22	23

Figure 1
Personal Injury Protection Coverage
Overall Injury Claim Frequencies
1982-84 Passenger Cars by Size

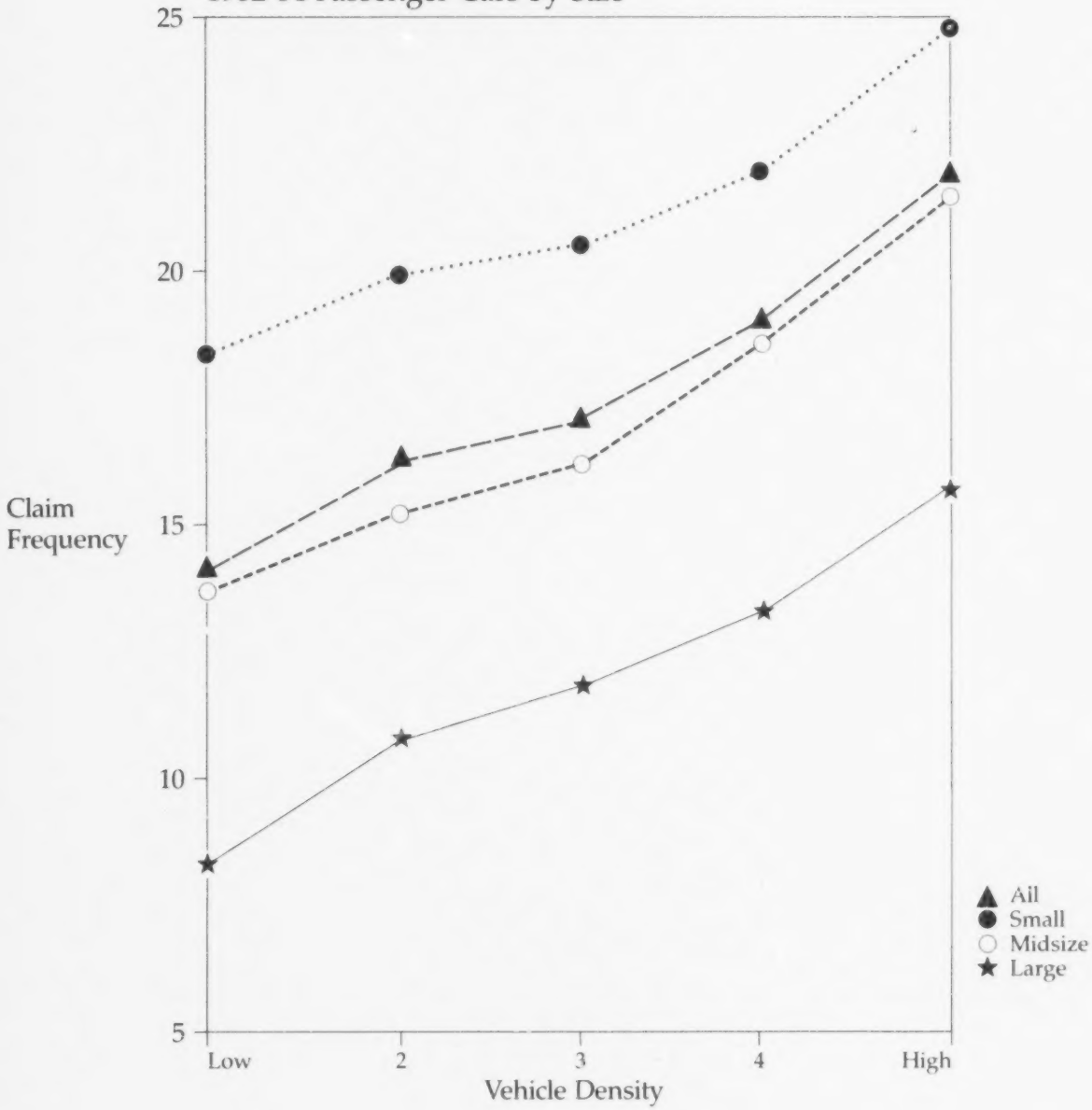


Figure 2
Personal Injury Protection Coverage
Overall Injury Claim Frequencies
1982-84 Vans, Pickups, and Utility Vehicles

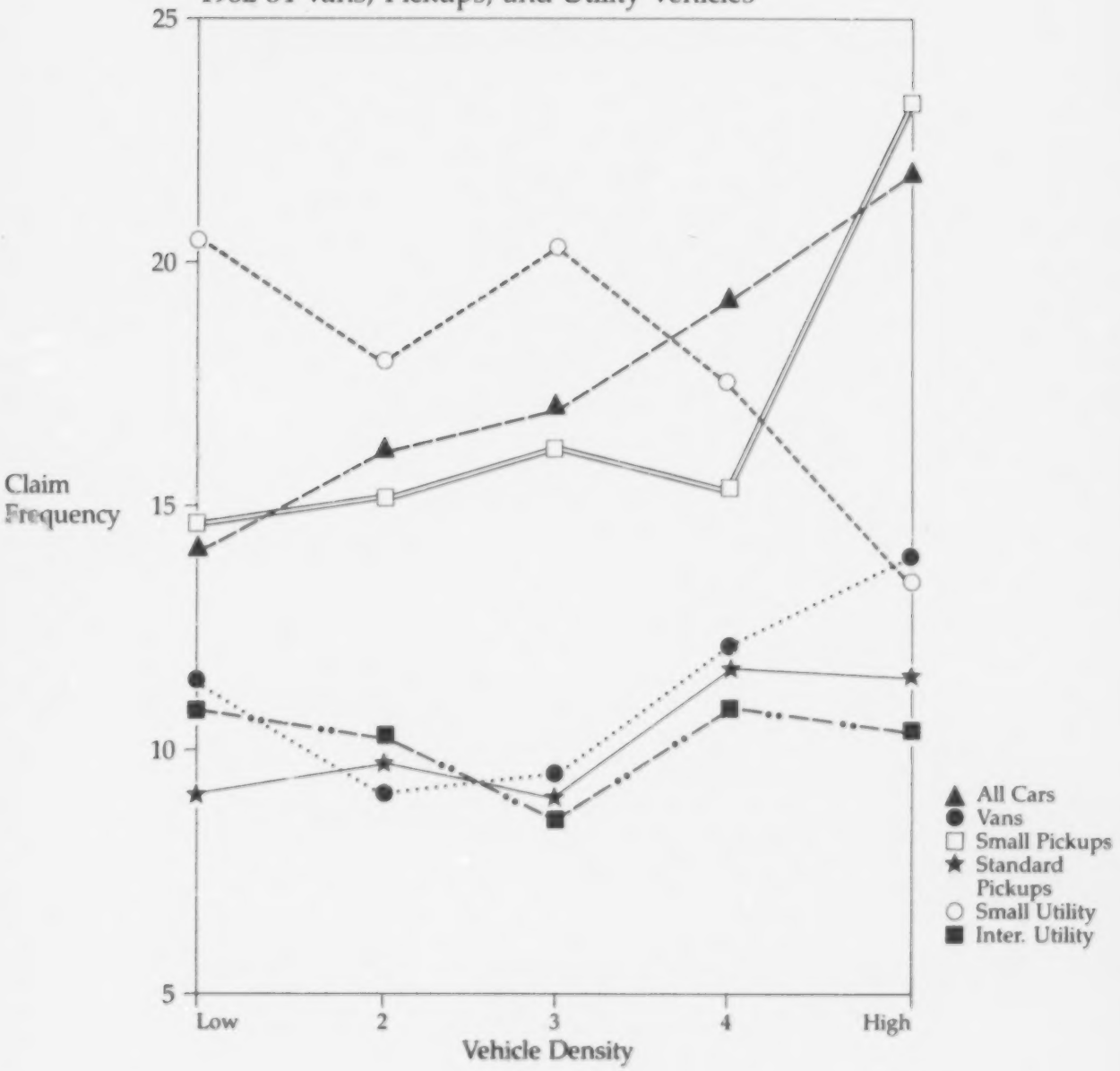


Figure 3
Personal Injury Protection Coverage
Overall Injury Claim Frequencies
1982-84 Passenger Cars by Body Style

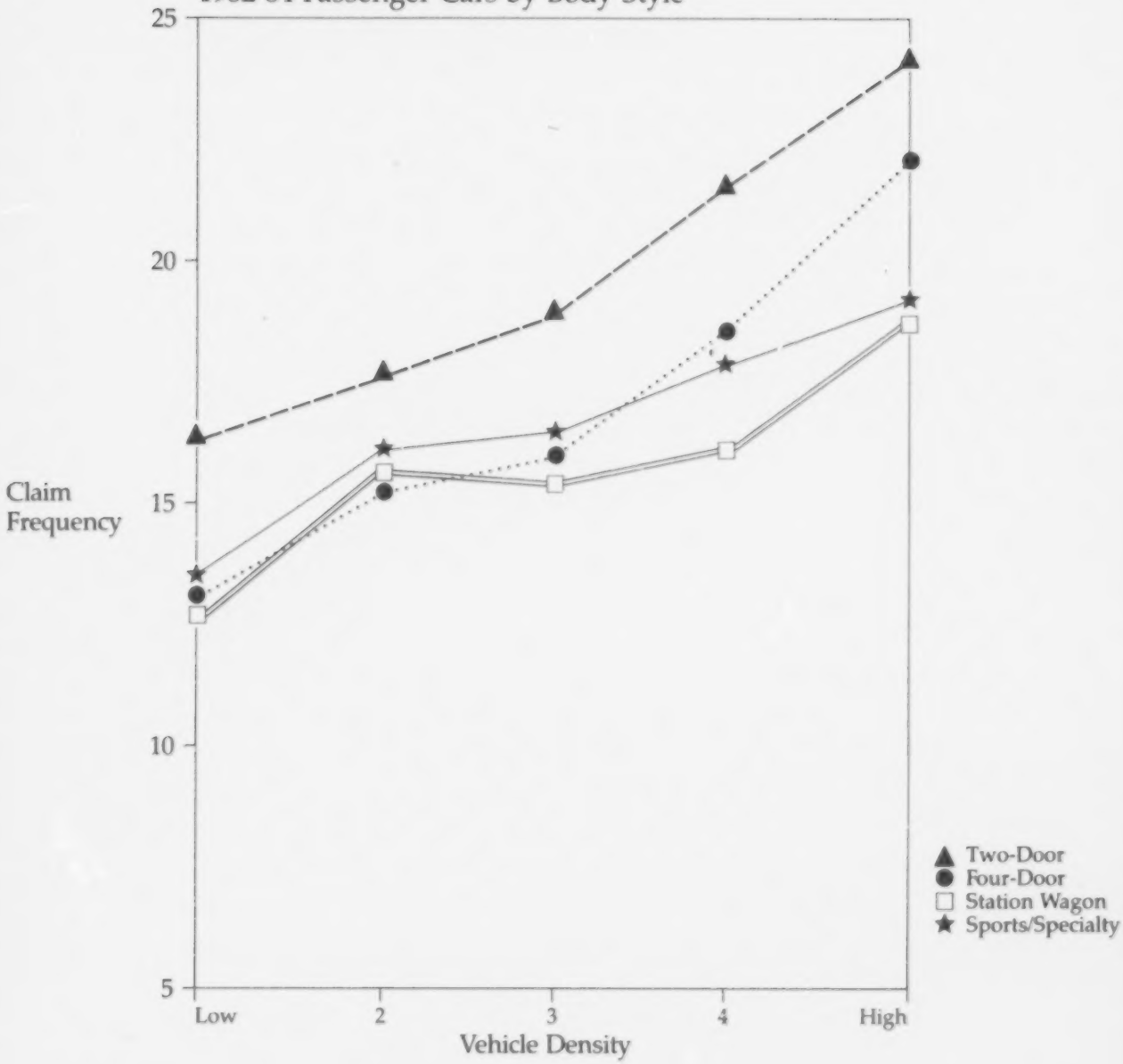


Figure 4
Personal Injury Protection Coverage
Claim Frequencies for Severe Injury (> $1000)
1982-84 Passenger Cars by Size

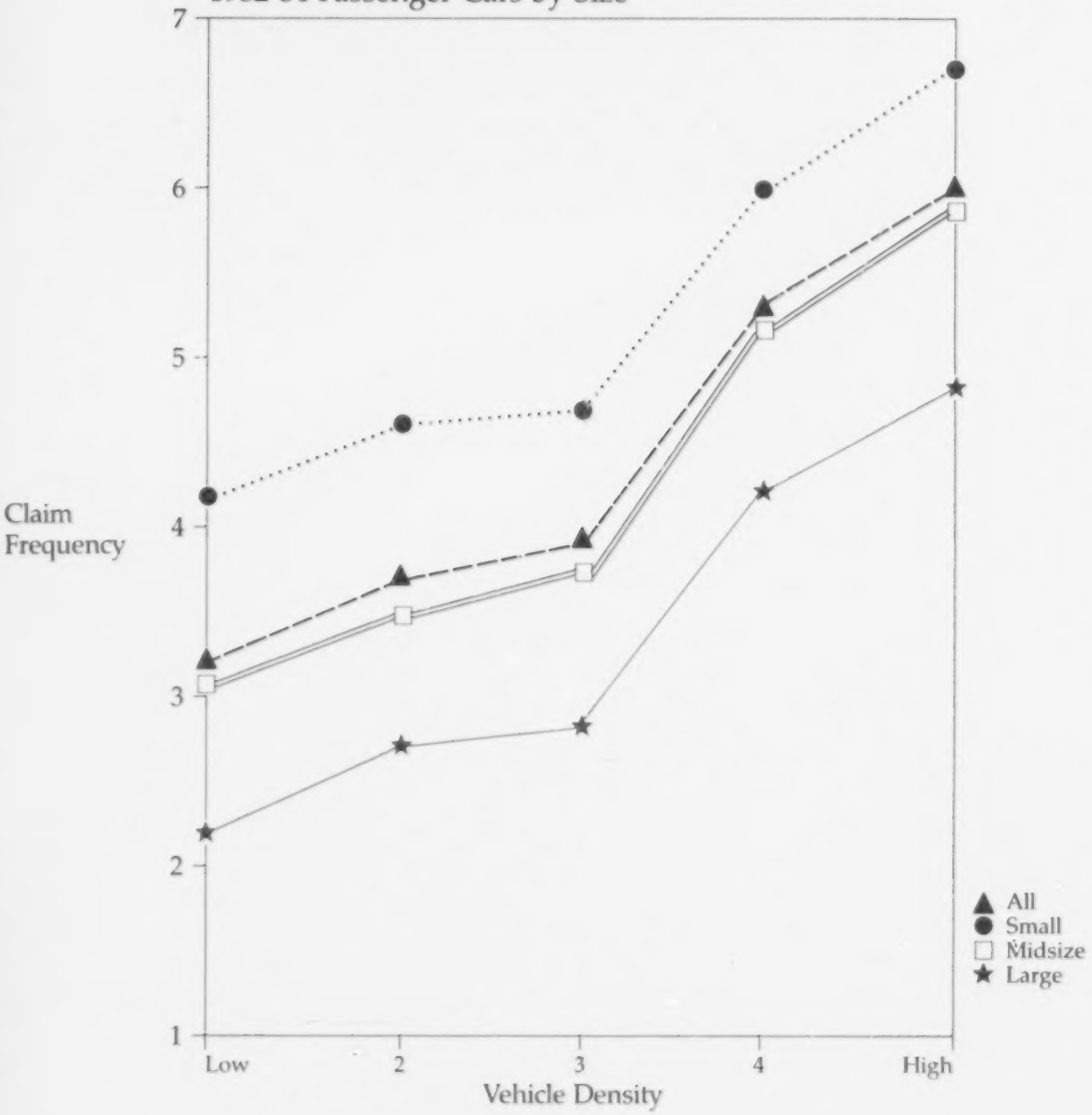


Figure 5
Personal Injury Protection Coverage
Claim Frequencies for Severe Injury (> $1000)
1982-84 Vans and Pickups

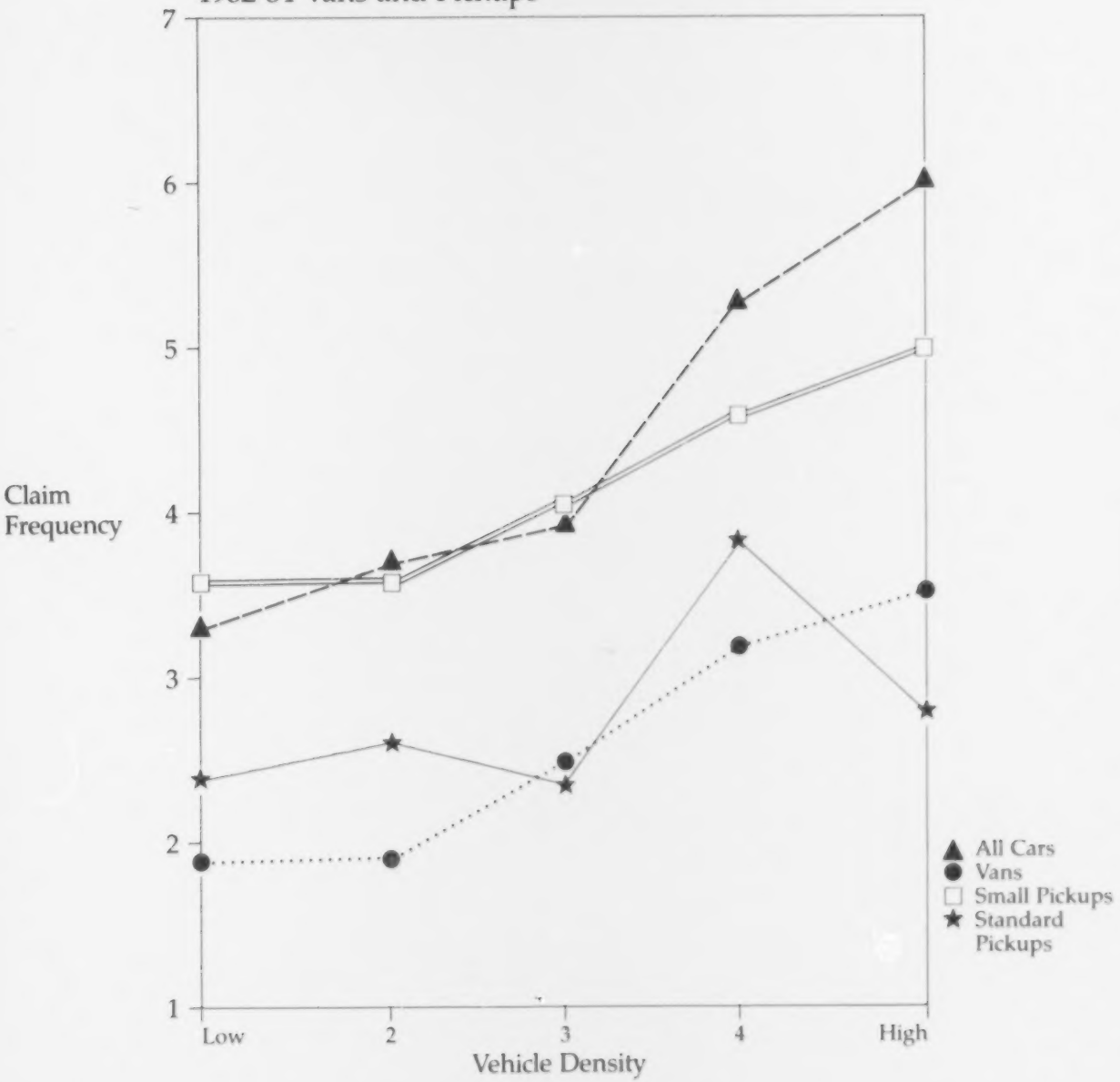


Figure 6
Personal Injury Protection Coverage
Claim Frequencies for Severe Injury (> $1000)
1982-84 Passenger Cars by Body Style

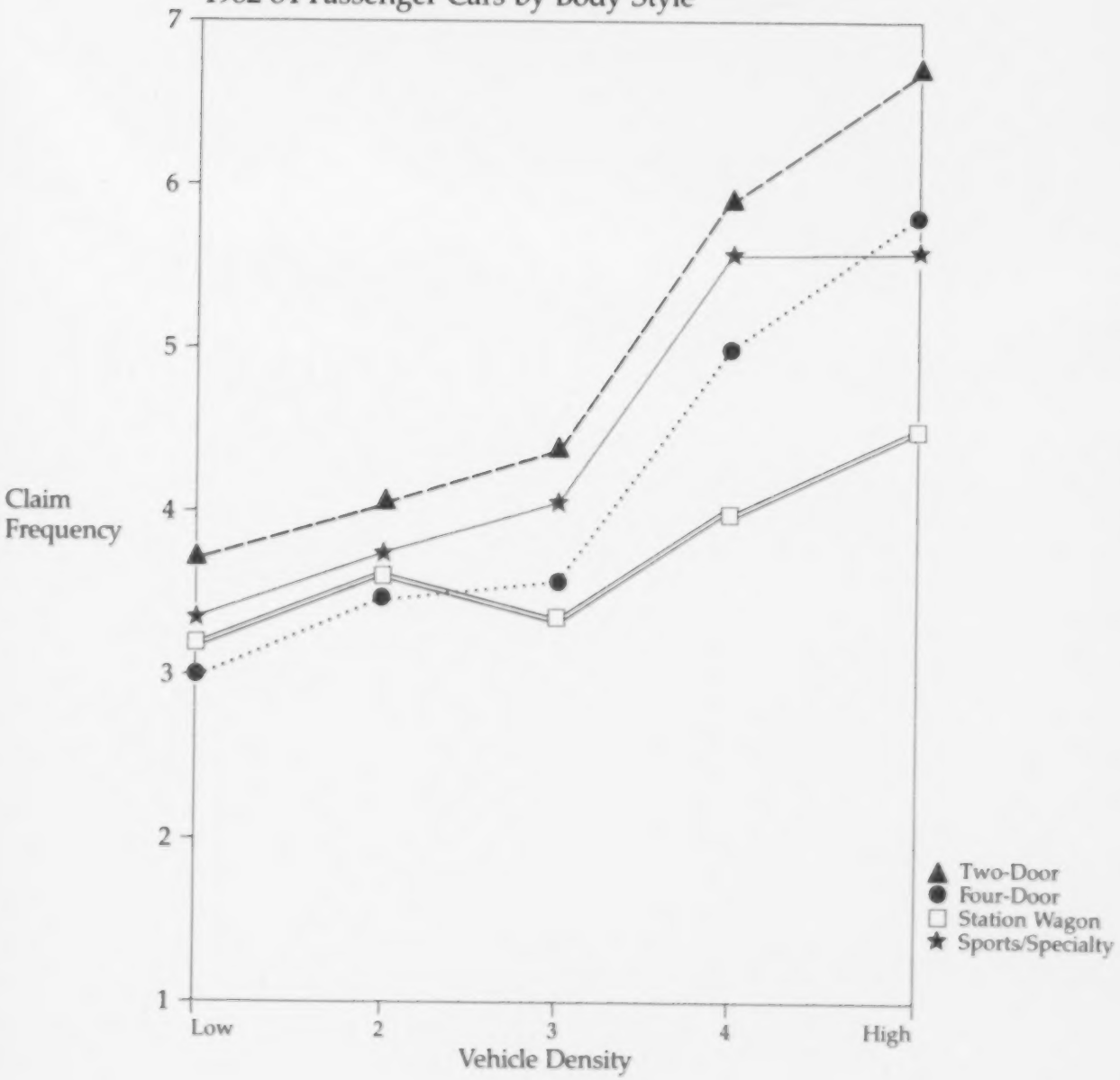


Figure 7
Collision Coverage Claim Frequencies
1982 Passenger Cars by Size

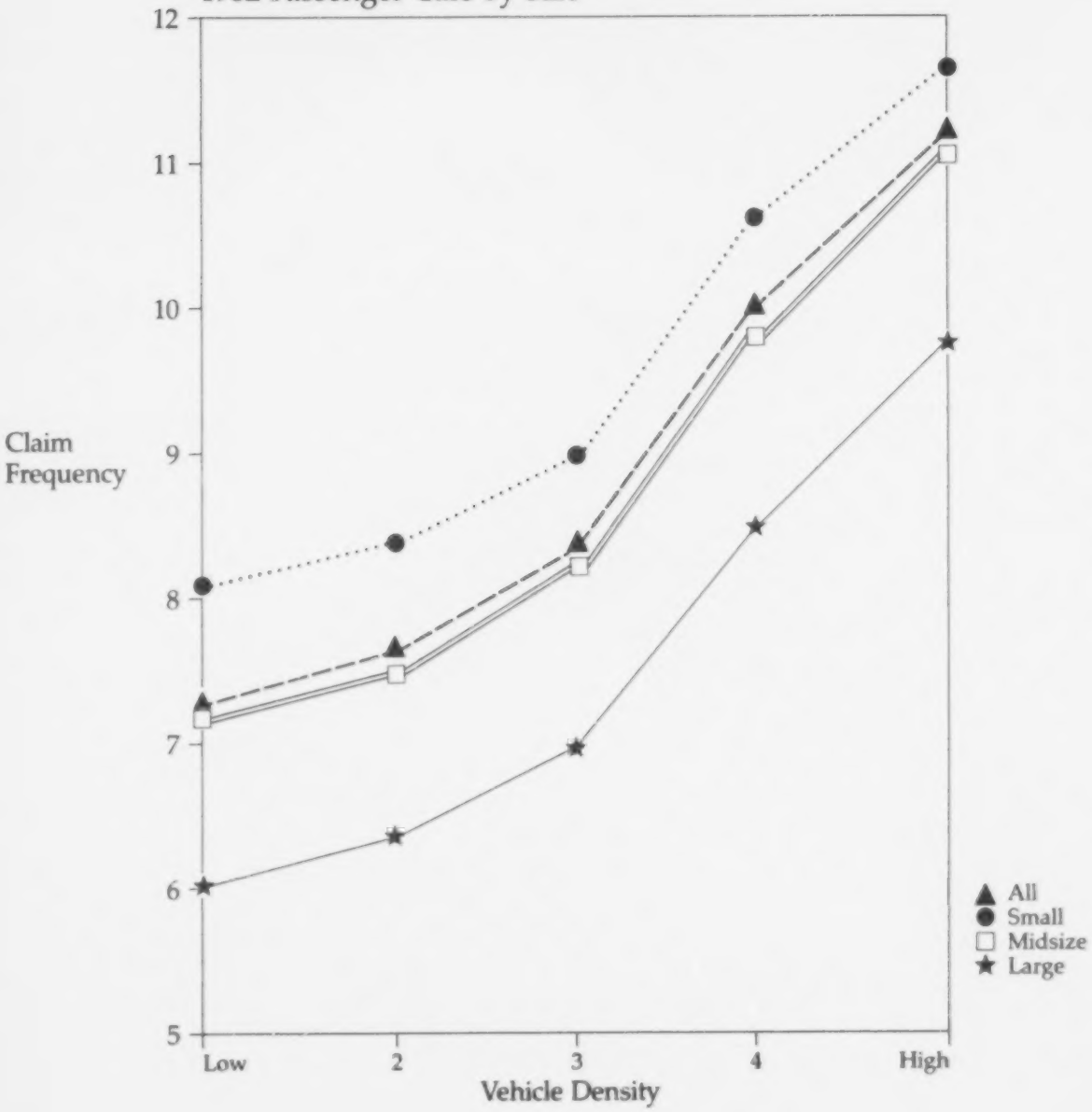


Figure 8
Collision Coverage Claim Frequencies
1982 Vans, Pickups, and Utility Vehicles

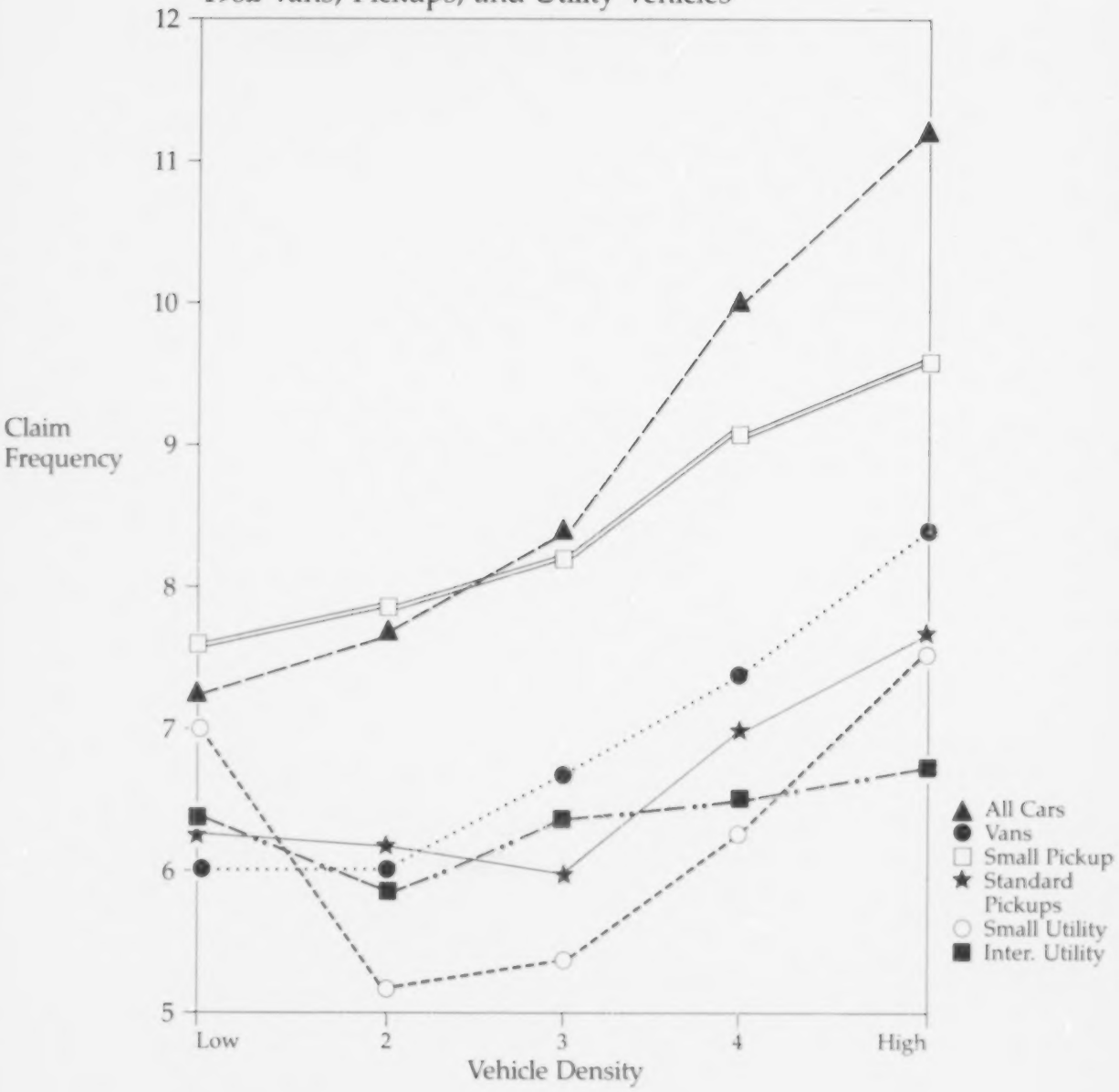


Figure 9
Collision Coverage Claim Frequencies
1982 Passenger Cars by Body Style

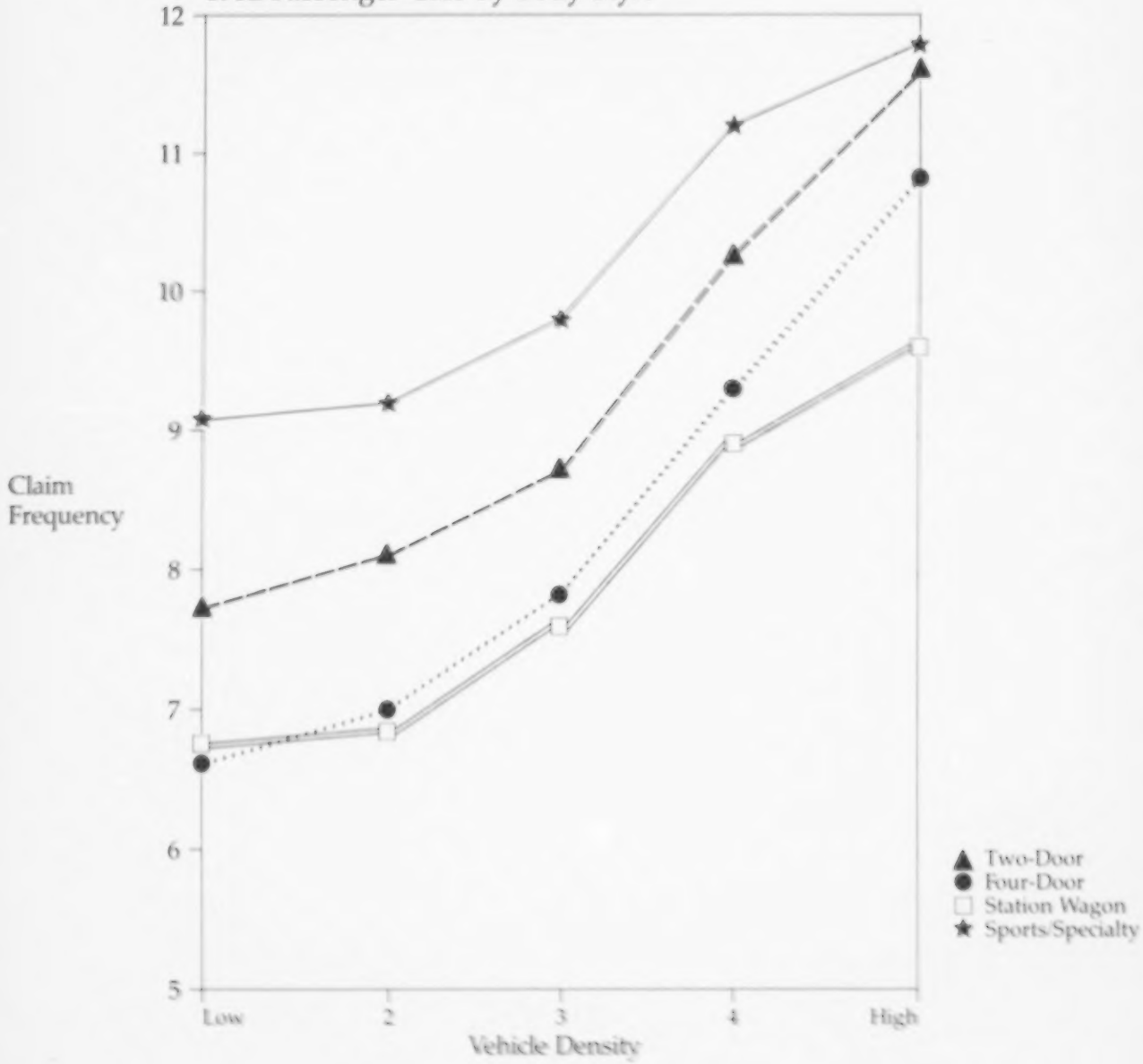


Figure 10
Collision Coverage
Average Loss Payment Per Claim
1982 Passenger Cars by Size

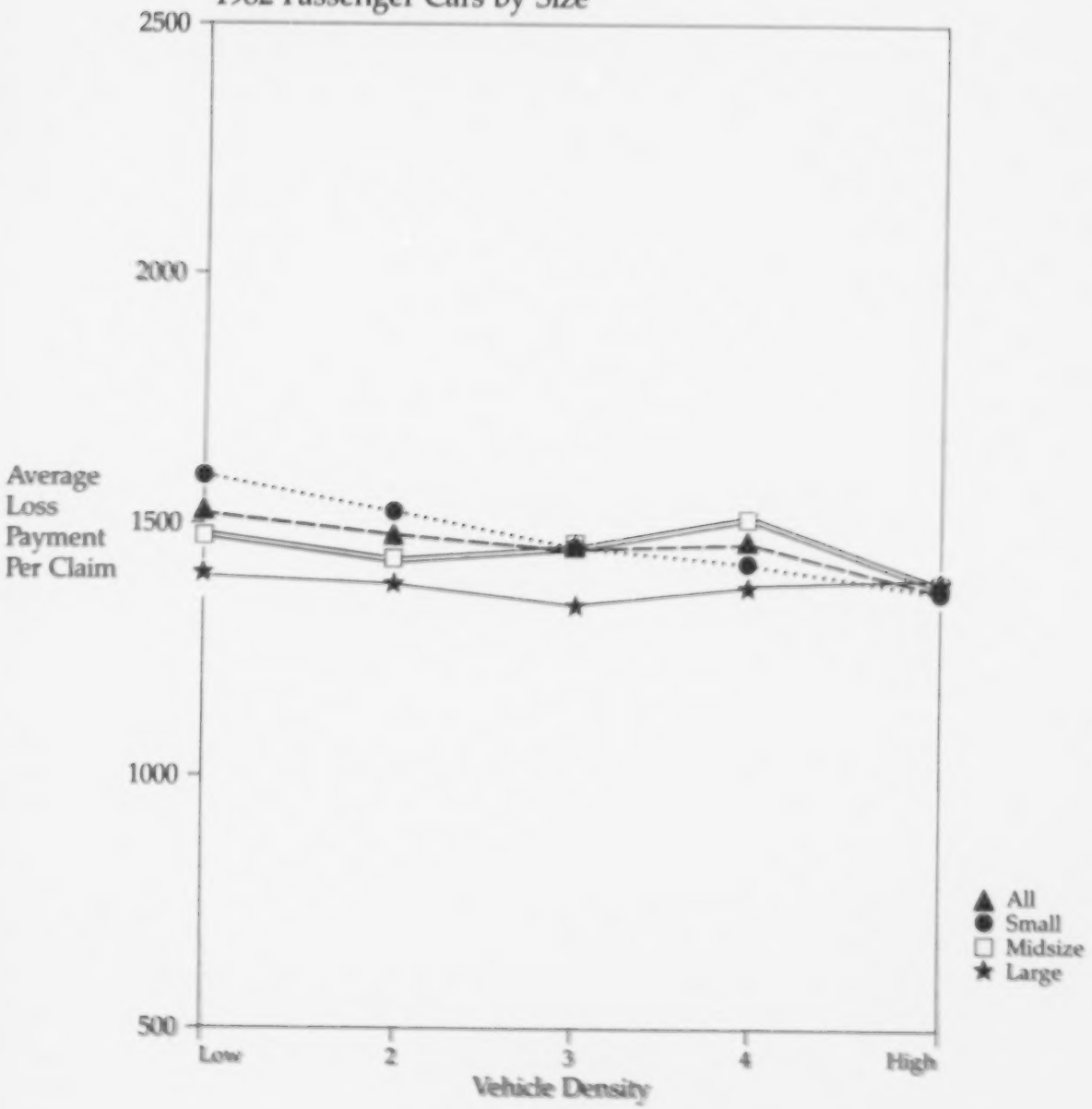


Figure 11
Collision Coverage
Average Loss Payment Per Claim
1982 Vans, Pickups, and Utility Vehicles

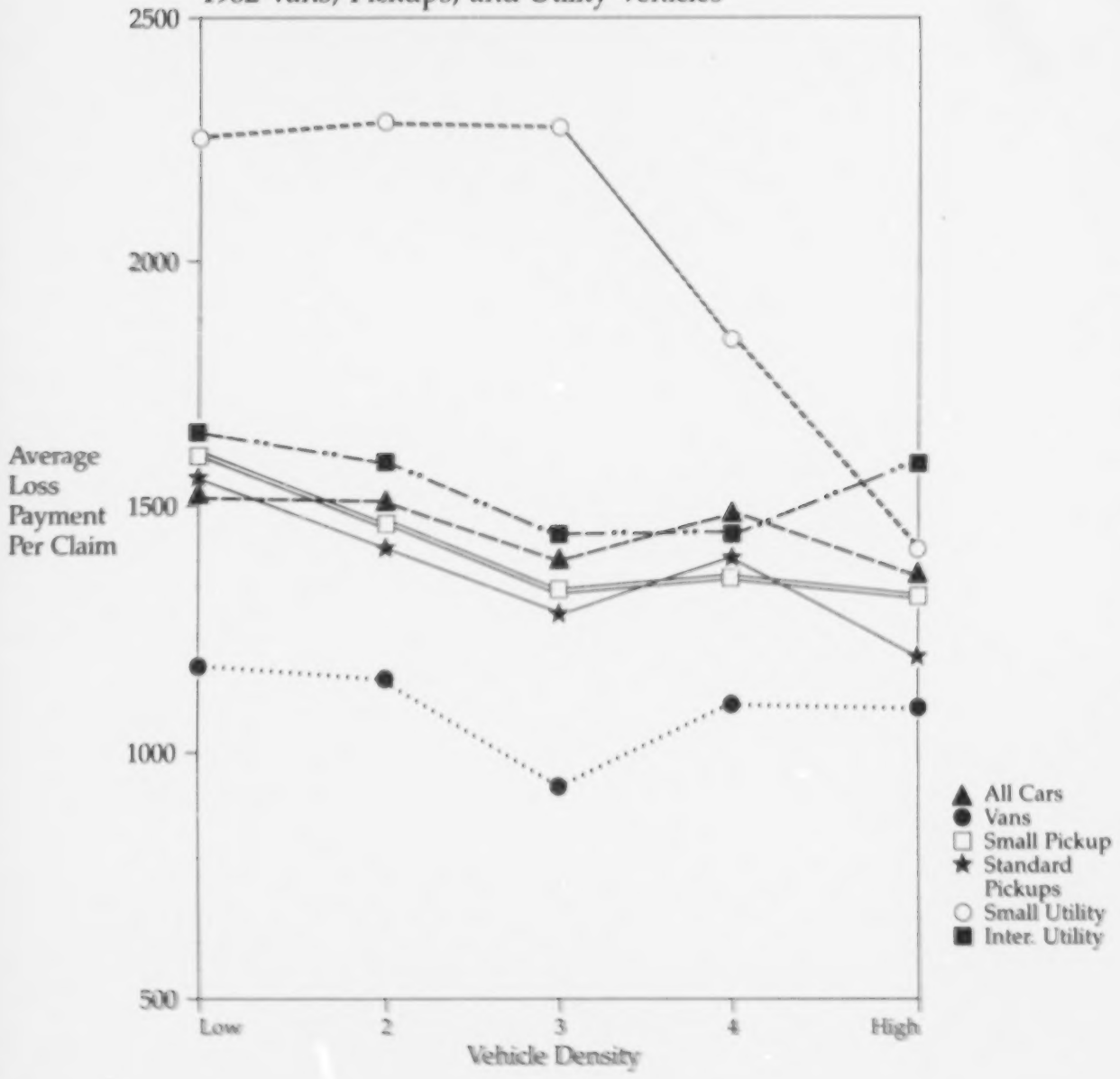


Figure 12
Collision Coverage
Average Loss Payment Per Claim
1982 Passenger Cars by Body Style

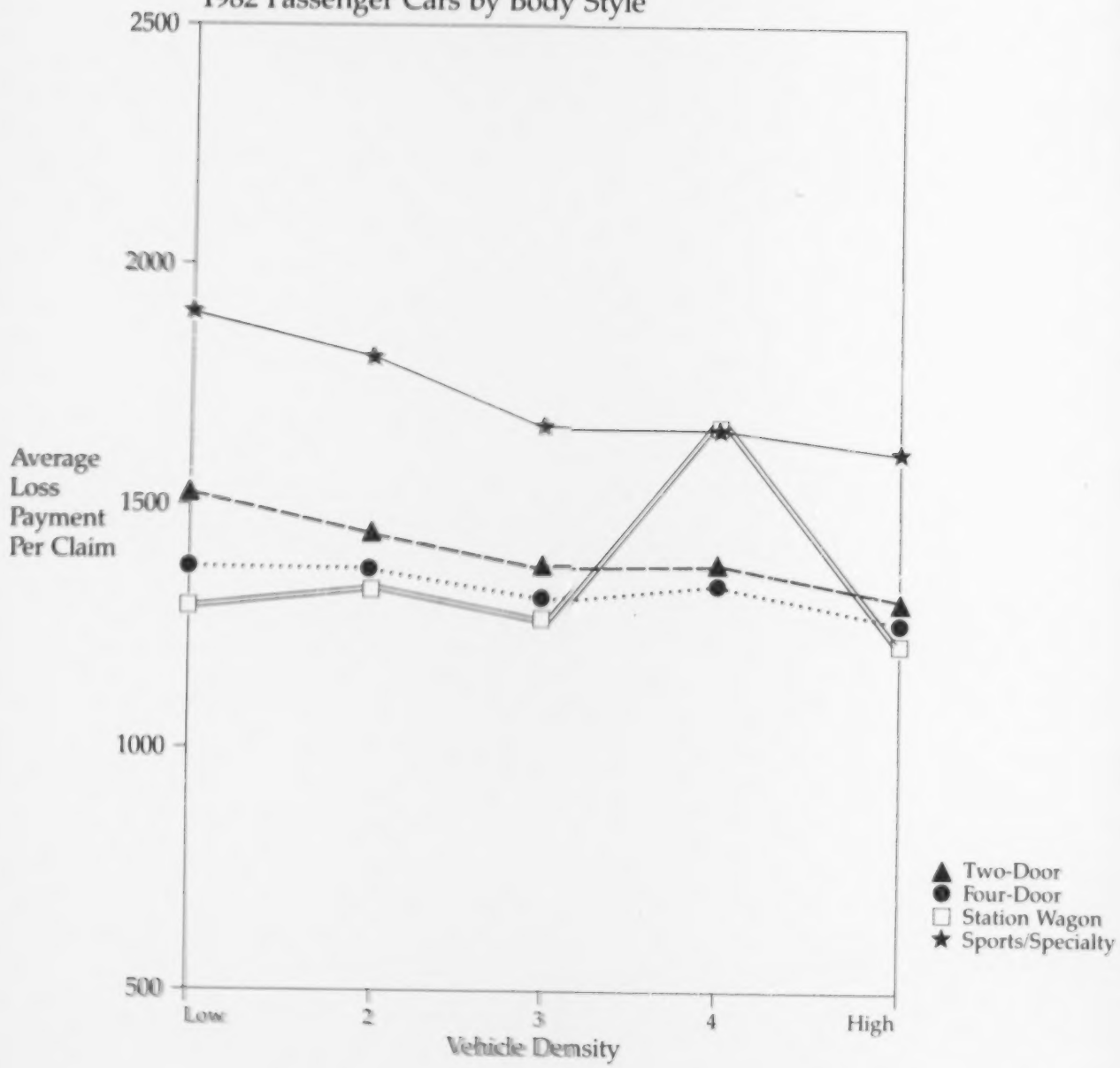


Figure 13
Collision Coverage
Average Loss Payment Per Insured Vehicle Year
1982 Passenger Cars by Size

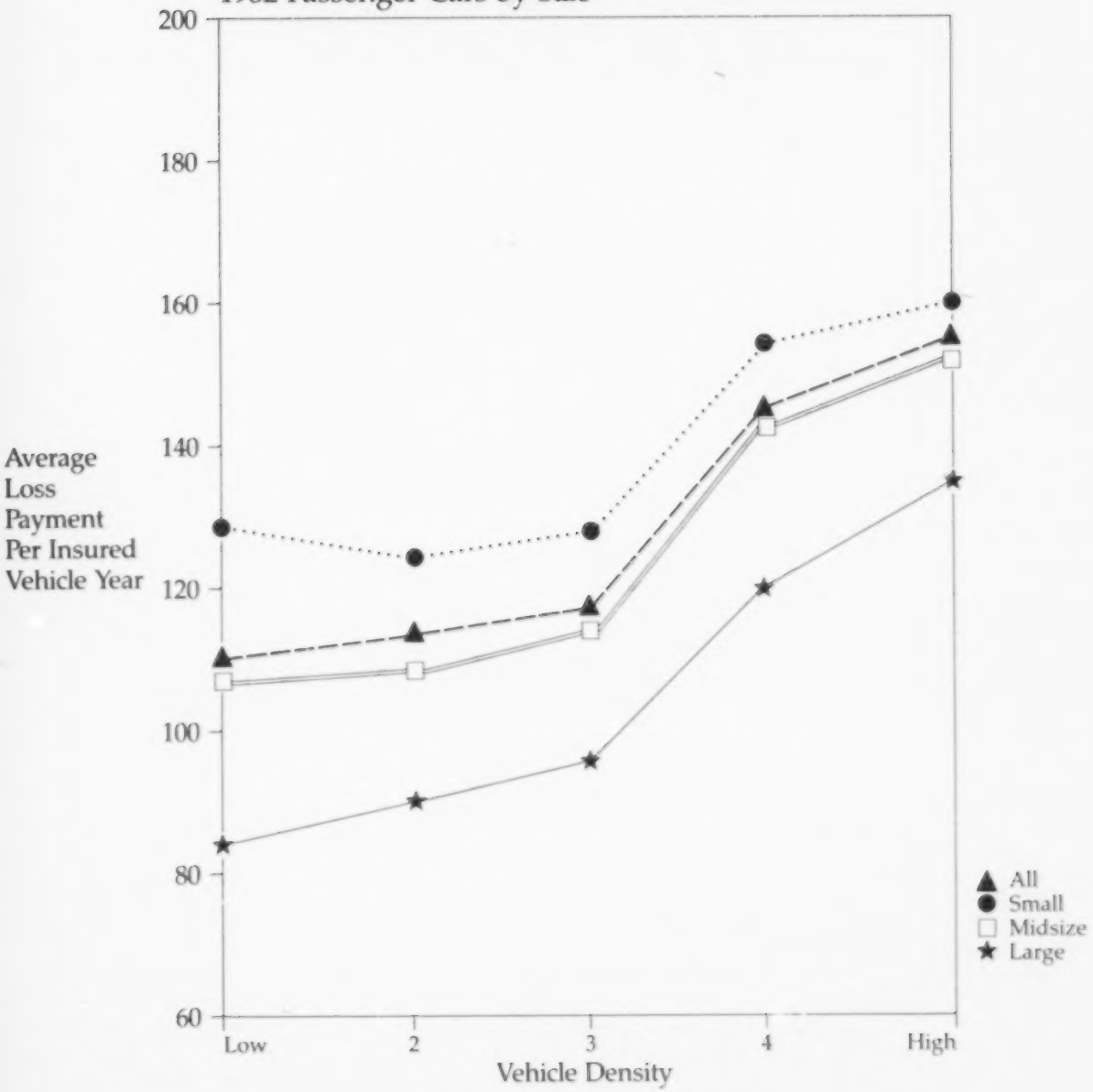


Figure 14
Collision Coverage
Average Loss Payment Per Insured Vehicle Year
1982 Vans, Pickups, and Utility Vehicles

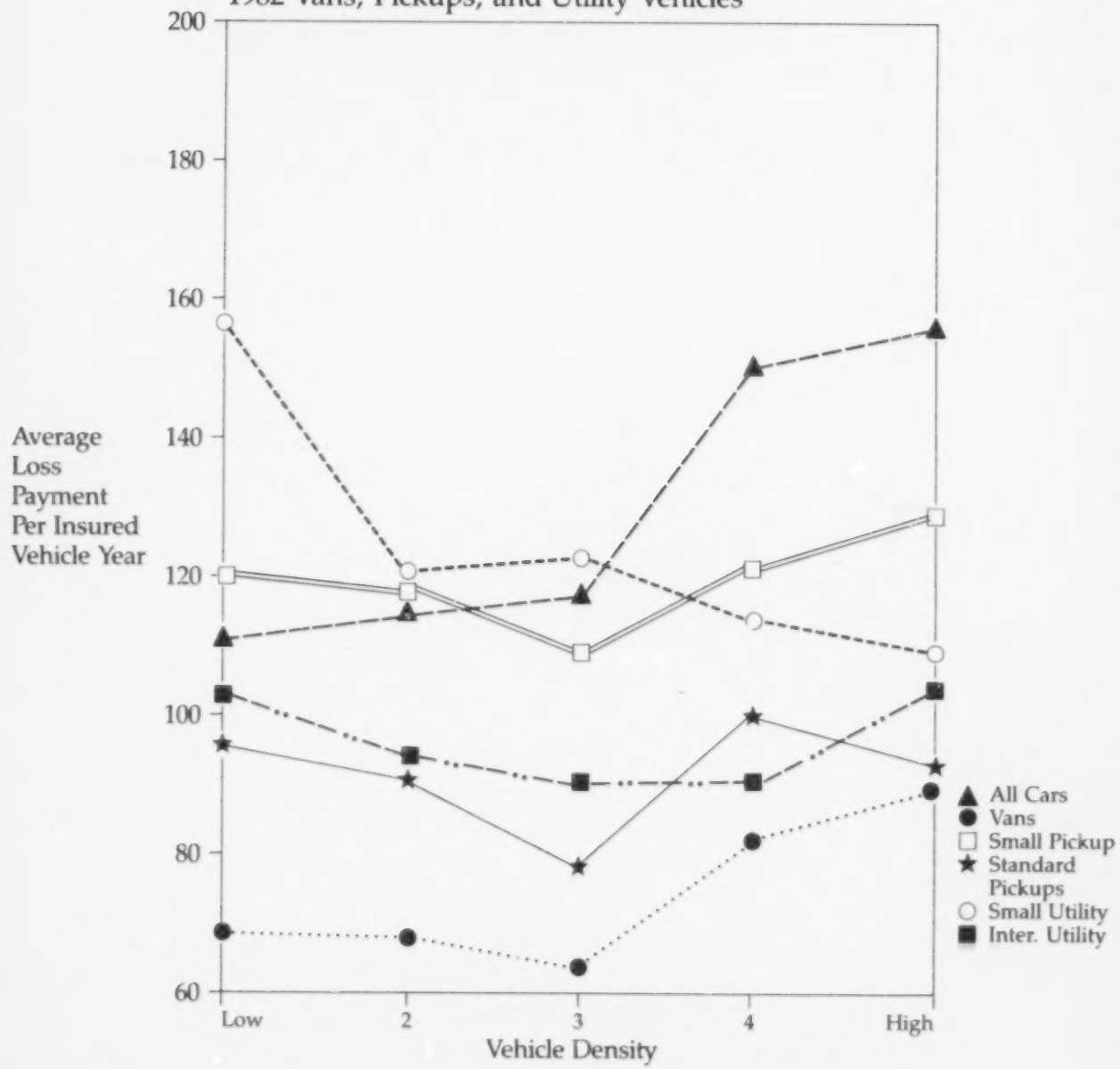
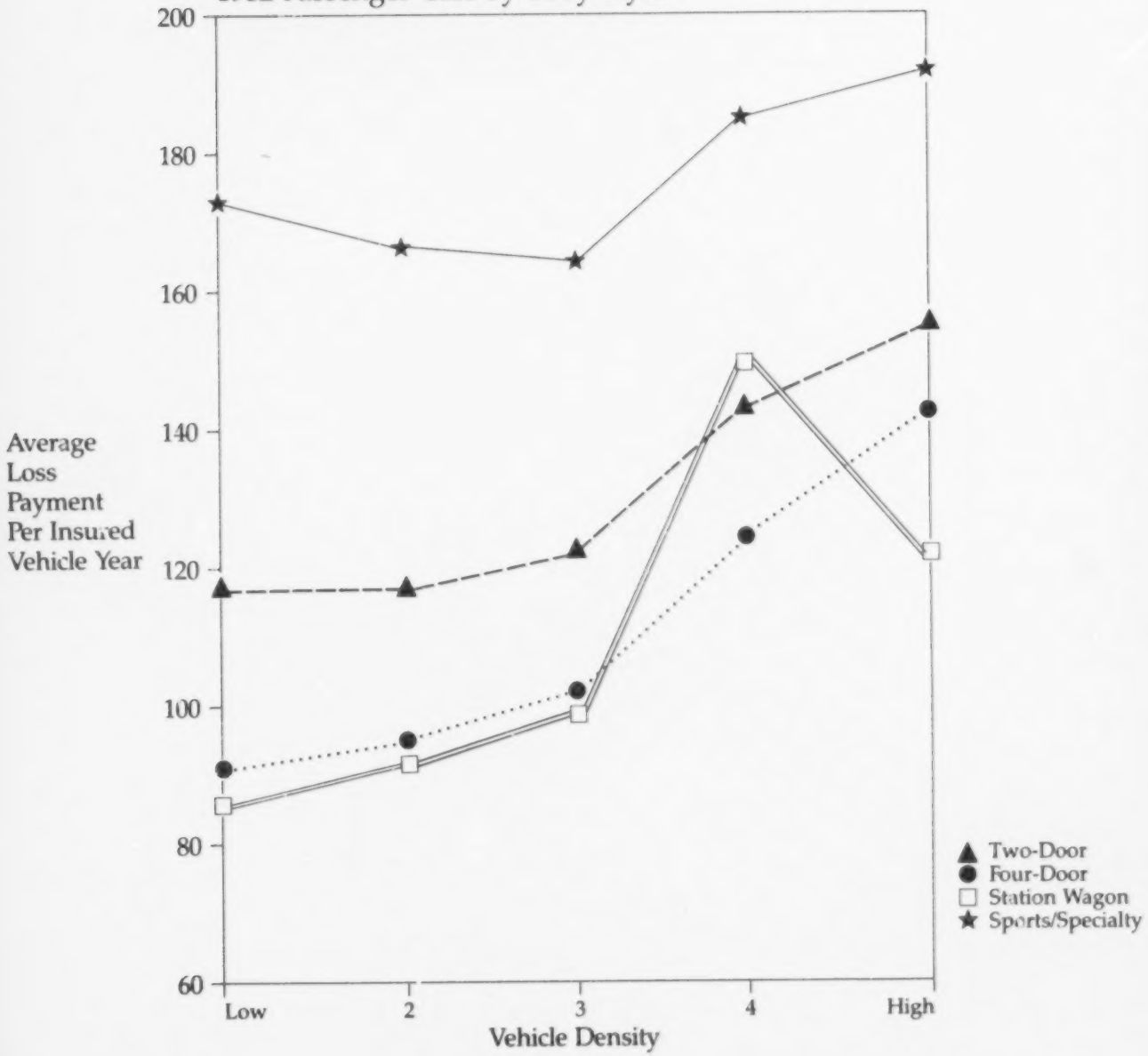


Figure 15
Collision Coverage
Average Loss Payment Per Insured Vehicle Year
1982 Passenger Cars by Body Style



APPENDIX A Standardization

Insurance loss experience varies in relation to certain nonvehicle factors. With respect to Personal Injury Protection (PIP) coverages, one important factor that influences loss experience is operator age. Youthful operators generally have worse loss experience than older drivers. Thus, the proportions of youthful operators must be taken into consideration in comparing the loss experience of different vehicles.

To remove any biases that could result because of variations among different vehicles in an operator age group, the PIP coverage results for the vehicles in this study were weighted, or standardized, to produce a weighted average of actual results. The weights used in the standardization procedure are shown below.

Operator Age Group	Distribution
Youthful	.10
Nonyouthful	.90

With respect to collision coverages, both the frequency and average size of collision losses vary with the deductible amount and the age group of the operators. Therefore, collision coverage results for the vehicles in this study were standardized using the weights shown below.

Deductible	Youthful Operator	Nonyouthful Operator
< $150	.05	.50
≥ $150	.05	.40

Standardizing these nonvehicle factors ensures that their mix is the same for each result. Therefore, to the extent that age distributions within each operator age group and amounts within each deductible group do not vary substantially for different vehicles, these effects will not bias comparisions among the various results.

The standarization procedure employed is widely used in health statistics.* The basic principle of the method is the introduction of a selected population with a standard distribution across operator age group, or across the combination of operator age group and deductible, as represented by the standardization weights in the tables.

APPENDIX B Definitions

Average Loss Payment per Claim — The total of all loss payments made for the claims for a group of vehicles, divided by the number of claims paid; expressed as dollars per claim.

Average Loss Payment per Insured Vehicle Year — For a group of vehicles, the product of Claim Frequency and Average Loss Payment per Claim, divided by 100; expressed as dollars per insured vehicle year. It should be noted that this definition differs from the commonly used insurance term, pure premium, but yields similar results.

Collision Claim Frequency — The number of claims for a group of vehicles, divided by the exposure for that group; expressed as claims per one hundred insured vehicle years.

Collision Coverages — As defined in insurance contracts, the coverage under which people insure their own vehicle against loss caused by collision.

Deductible Amount — That portion of the collision damage cost borne by the policyholder. For computing results, deductible amounts are split into two groups; less than $150 (mainly $50 and $100 deductibles) and greater than or equal to $150 (mainly $200 and $250 deductibles).

Exposure — The time interval an individual vehicle is insured. Exposure for a group of vehicles is expressed in units of insured vehicle years.

Personal Injury Protection (PIP) Claim Frequency — The number of claims for a group of vehicles, divided by the exposure for that group; expressed as claims per one thousand insured vehicle years.

Personal Injury Protection Coverage — First-party no-fault coverage in which an insurer pays, within the specified limits, the medical, hospital, and other expenses of the insured, others in his vehicle, and pedestrians struck by him.

Operator Age Group — The factor that distinguishes those vehicles whose rated driver is youthful from those vehicles whose rated driver is not youthful (see Youthful Operator).

Rated Driver — The driver who, for insurance purposes, is considered to represent the greatest loss potential for the insured vehicle.

Vehicle Class — The four vehicle classes are defined as follows:

1. Passenger Vehicles — There are four major body style groupings of passenger vehicles — regular two-door models, regular four-door models, station wagons and passenger vans, and sports and specialty models. Sports and specialty models include all two-seater cars, all convertibles, all midsize and large cars with two or fewer designated rear seating positions, and all luxury cars. Each body style group is further divided into size class subgroups based on wheelbase (rounded to nearest inch) defined as follows:

*For example, see Armitage, P. *Statistical Methods in Medical Research*, Wiley, New York (1971).

Small — Vehicles with wheelbases less than or equal to 99 inches.

Midsize — Vehicles with wheelbases greater than 99 inches and less than or equal to 109 inches.

Large — Vehicles with wheelbases greater than 109 inches.

2. Vans — Fully enclosed vehicles with either no hood or a very short hood, in which the engine is placed at least 50 percent behind the windshield. The driver's position is usually well forward, nearly beside the engine, usually within the forward 25 percent of the wheelbase. These vehicles are designed for cargo transport and are equipped with a right side cargo access door and rear door. The cargo area is not separated from the passenger area — both are enclosed under the same roof. Some passenger vans are equipped with additional seats in the cargo area and usually have additional side windows also.

3. Pickups — Cargo-carrying vehicles, usually on a truck chassis, with an enclosed cab and a separate open cargo area. The open cargo area generally is a box with raised sides with an opening tailgate. There are also a small number of auto pickups that are similar to regular pickups except that they are built on a passenger car chassis. Pickups are further divided into two subgroups based on curb weight — small pickups (less than 3,000 pounds) and standard pickups (3,000 pounds or more).

4. Utility Vehicles — Vehicles built on a heavy-duty chassis capable of off-road use. They are of conventional construction with the driver behind the engine. The cargo and passenger areas are integral with the driver area. Many of these vehicles are equipped with soft or removable tops. Frequently, these vehicles are equipped with four-wheel drive. Utility vehicles are further divided into three subgroups based on wheelbase — small utility vehicles (less than 100 inches), intermediate utility vehicles (from 100 to 120 inches), and large utility vehicles (greater than 120 inches).

Vehicle Identification Number (VIN) — A code, variously comprising both numbers and letters; normally, 8 to 17 characters in length, assigned to each vehicle by its manufacturer. The VIN uniquely identifies the vehicle within at least a ten-year span and, in recent model year vehicles, contains coding which identifies the make, series, model year, and other characteristics of each vehicle.

Vehicle Series — A name denoting a family of vehicles, within a make, with the same wheelbase and a degree of commonality in construction such as body, chassis, etc.

Youthful Operator — For the purposes of this report, all males (married or single) under 25 years of age and all unmarried females under 25 years of age.

HLDI Publications

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Consistency of Model Year Injury Claim Frequency Results For Selected 1981-1983 Models

Highway Loss Data Institute
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Highway Loss Data Institute Insurance Special Report

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HLDI A-26

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SUMMARY

The Highway Loss Data Institute (HLDI) publishes annual reports of injury loss results that aggregate up to three model years of injury loss data for vehicle series with essentially unchanged designs. Aggregation of the loss data is necessary to obtain a sufficient amount of data to produce reliable results for each vehicle series.

This study compared the all-claims injury results data of 118 different vehicle series for at least two of the model years 1981-83. Of the 230 paired comparisons of individual model year data, 223 had claim frequency results that did not differ significantly. The seven paired comparisons that did indicate differences between model year results are within the number expected by chance alone. Thus, this study demonstrates that the injury results for individual model year vehicles are generally consistent across model years when the basic vehicle designs are unchanged.

INTRODUCTION

The Highway Loss Data Institute (HLDI) is a nonprofit, public service organization that gathers, processes, and publishes insurance data concerning the human and economic losses associated with motor vehicles — especially the ways such losses vary among different kinds of vehicles. As part of its reporting activities, HLDI annually publishes a report summarizing injury losses for recent model year vehicles (e.g., see HLDI Report I84-1: Insurance Losses, Personal Injury Protection Coverages — Passenger Cars, Vans, Pickups, and Utility Vehicles, 1982-1984 Models). These reports are usually based on the injury loss experience aggregated for three model years of individual vehicle series. Aggregated results are used to increase the amount of exposure* and hence the reliability of the claim frequency results. Each vehicle series is reviewed to verify basic design similarity for the model years included in the study. This report presents a formal statistical analysis comparing the individual model year results for vehicles whose combined results have been included in previous HLDI reports.

The report is based on personal injury protection data supplied by 13 insurers: Aetna, Allstate, Fireman's Fund, GEICO, Kemper, Liberty Mutual, Nationwide, Prudential, Safeco, Sentry, State Farm, Travelers, and USAA.

*See Appendix B, Definitions.

METHOD OF DATA ANALYSIS

This report compares the individual model year injury results that were used to produce the aggregated results for 1981-83 models in HLDI report I83-1 and 1982-84 models in HLDI report I84-1. The most recent model year claim frequency results (model year 1983 in the I83-1 report and model year 1984 in the I84-1 report) were not used. These results were excluded because they were generally based on the least amount of exposure among the three model years used for each report and thus were the least reliable. In addition, only 1981 and 1982 model year vehicles (from the I83-1 report) and 1982 and 1983 models (from the I84-1 report) with at least 5,000 insured vehicle years of exposure for each model year were used in this analysis. Eighty-five vehicles included in the I83-1 report and 89 vehicles included in the I84-1 report satisfied these exposure criteria. Fifty-six of these vehicle series were covered by both reports so that 118 different vehicle series had sufficient exposure in two model years to be included in this analysis.

The results for individual vehicle series in different model years are, of course, based on different amounts of exposure. Confidence in the results increases with the amount of exposure. To account for these differences in exposure in comparing model year results (e.g., model year 1981 vs. 1982) for a vehicle series, confidence intervals were constructed for each model year result. A confidence interval provides a range of values that contains the actual model year claim frequency at a specified confidence or probability level (e.g., 95 percent confidence). These intervals are wider for estimates that are more variable and narrower for less variable estimates. The confidence intervals can then be used to determine whether two model year claim frequencies are statistically equivalent because differences in variability have been incorporated into the intervals.

Model year claim frequency results for individual vehicle series and for all passenger cars combined were standardized by operator age group. Relative claim frequency results for individual vehicle series were calculated by dividing each vehicle's standardized model year result by the standardized model year result for all passenger cars. Standardization and the conversion of results to a relative basis are discussed in detail in the annual injury reports (see, e.g., HLDI I84-1, pages 19-21). Ninety-five percent confidence intervals were constructed for each vehicle's model year relative claim frequency (see Appendix A). The confidence intervals were used as the basis for paired comparisons of model year claim frequencies for each vehicle series. Overlapping intervals indicate that the individual model year results are similar. Conversely, confidence intervals that do not overlap indicate a greater than expected difference between two model year claim frequencies.

RESULTS AND DISCUSSION

The individual model year relative claim frequencies for the vehicle series meeting the exposure requirements are given in Table 1. For each vehicle series for which relative claim frequency results were available, the following comparisons were made: using I83-1 data, results for model year 1981 passenger cars were compared to those for model year 1982 (identified as Model Year 1982a in Table 1); using I84-1 data, model year results for 1982 (Model Year 1982b in Table 1) and 1983 were compared; finally, the 1981 model year results were compared to the results for model year 1983. A total of 230 model-year pairs were evaluated using the confidence interval methodology. The number of comparisons for each paired set of model years is given in the following tabulation:

Model Year	Numbers of Model Year Comparisons
1981 vs. 1982a	85
1982b vs. 1983	89
1981 vs. 1983	56
Total	**230**

Two hundred twenty-three of the 230 individual paired comparisons were not statistically different (i.e., the paired confidence intervals overlapped). The seven paired comparisons that did indicate differences between specific pairs of model year results are within the number expected merely by statistical chance. Thus, the individual model year injury claim frequency results are consistent from year to year for vehicles with essentially unchanged designs.

Table 1
Relative Injury Claim Frequency by Model Year for 1981-1983 Passenger Cars*

MAKE	SERIES	MODEL YEAR** 1981	1982a	1982b	1983
	SMALL CARS				
TWO-DOOR MODELS					
CHEVROLET	CHEVETTE	135	154	150	165
DODGE	CHARGER/OMNI	128	134	130	129
DODGE	COLT	144	170	152	136
FORD	ESCORT	116	125	128	134
HONDA	ACCORD	-	-	105	103
HONDA	CIVIC CVCC	120	118	-	-
MAZDA	GLC	118	90	95	127
MERCURY	LYNX	117	131	140	131
NISSAN	SENTRA	-	-	121	138
NISSAN	200SX	136	122	-	-
PLYMOUTH	CHAMP/COLT	134	152	-	-
PLYMOUTH	HORIZON	122	133	130	123
PONTIAC	1000	158	155	-	-
SUBARU	HARDTOP	153	127	-	-
SUBARU	HATCHBACK	120	126	-	-
TOYOTA	CELICA	-	-	120	122
TOYOTA	COROLLA	141	133	-	-
TOYOTA	STARLET	130	148	-	-
VOLKSWAGEN	RABBIT	96	107	-	-
FOUR-DOOR MODELS					
CHEVROLET	CHEVETTE	123	137	140	150
DODGE	OMNI	111	109	114	115
FORD	ESCORT	-	-	115	129
HONDA	ACCORD	-	-	83	95
HONDA	CIVIC	113	113	-	-
MAZDA	GLC	111	123	116	149
MERCURY	LYNX	-	-	116	131
NISSAN	SENTRA	-	-	129	150
NISSAN	STANZA	-	-	111	106
PLYMOUTH	HORIZON	109	111	112	122
PONTIAC	1000	126	135	-	-
SUBARU	DL/GL SEDAN	124	123	119	136
TOYOTA	COROLLA	129	139	-	-
VOLKSWAGEN	JETTA	79	95	-	-
VOLKSWAGEN	RABBIT	93	84	-	-

(See notes on Page 6)

Table 1 (Cont'd)
Relative Injury Claim Frequency by Model Year for 1981-1983 Passenger Cars*

MAKE	SERIES	MODEL YEAR** 1981	1982a	1982b	1983
SMALL CARS (CONT'D)					
STATION WAGONS/PASSENGER VANS					
FORD	ESCORT	92	92	92	97
HONDA	CIVIC	100	97	-	-
MERCURY	LYNX	86	80	-	-
NISSAN	SENTRA	-	-	110	111
SUBARU	DL/GL 4WD	92	109	104	88
SUBARU	DL/GL	97	96	97	105
TOYOTA	COROLLA	109	97	-	-
SPORTS & SPECIALTY					
CHEVROLET	CORVETTE	89	103	-	-
FORD	EXP	-	-	121	140
MAZDA	RX-7	101	101	101	106
NISSAN	280ZX	104	113	-	-
MIDSIZE CARS					
TWO-DOOR MODELS					
BUICK	REGAL	90	83	88	90
BUICK	SKYHAWK	-	-	126	117
BUICK	SKYLARK	94	98	99	90
CHEVROLET	CAVALIER	-	-	120	135
CHEVROLET	CITATION	104	111	-	-
CHEVROLET	MONTE CARLO	100	102	101	96
CHRYSLER	LE BARON	-	-	102	100
DODGE	ARIES	105	97	103	119
FORD	FUTURA	109	92	-	-
MERCURY	CAPRI	124	109	-	-
OLDSMOBILE	CIERA	-	-	91	94
OLDSMOBILE	CUTLASS	90	87	90	85
OLDSMOBILE	OMEGA	94	90	-	-
PLYMOUTH	RELIANT	111	121	123	114
PONTIAC	GRAND PRIX	90	90	97	89
PONTIAC	2000	-	-	114	117
FOUR-DOOR MODELS					
BUICK	CENTURY	-	-	88	92
BUICK	REGAL	78	82	81	77
BUICK	SKYHAWK	-	-	116	122

(See notes on Page 6)

Table 1 (Cont'd)
Relative Injury Claim Frequency by Model Year for 1981-1983 Passenger Cars*

MAKE	SERIES	MODEL YEAR** 1981	1982a	1982b	1983
MIDSIZE CARS (CONT'D)					
FOUR-DOOR MODELS (CONT'D)					
BUICK	SKYLARK	87	85	92	92
CADILLAC	CIMARRON	-	-	96	90
CHEVROLET	CAVALIER	-	-	111	109
CHEVROLET	CELEBRITY	-	-	99	89
CHEVROLET	CITATION	99	91	94	93
CHEVROLET	MALIBU	90	96	-	-
CHRYSLER	LE BARON	-	-	89	88
DODGE	ARIES	106	101	112	110
FORD	FUTURA	108	103	-	-
NISSAN	810/MAXIMA	108	123	117	123
OLDSMOBILE	CIERA	-	-	91	87
OLDSMOBILE	CUTLASS	77	74	75	73
OLDSMOBILE	OMEGA	91	88	98	99
PONTIAC	2000	-	-	106	103
PONTIAC	6000	-	-	104	77
PONTIAC	BONNEVILLE	79	80	82	80
PONTIAC	PHOENIX	93	106	-	-
PLYMOUTH	RELIANT	99	113	111	119
TOYOTA	CRESSIDA	92	87	92	87
VOLVO	240	86	98	92	92
STATION WAGONS/PASSENGER VANS					
AMERICAN	EAGLE 30	-	-	70	62
CHEVROLET	CAVALIER	-	-	93	96
CHEVROLET	MALIBU	78	72	-	-
DODGE	ARIES	89	89	93	92
PLYMOUTH	RELIANT	89	96	103	83
VOLVO	240	78	61	53	63
SPORTS & SPECIALTY					
BMW	320i	90	92	-	-
CHEVROLET	CAMARO	-	-	110	115
FORD	MUSTANG	116	129	128	124
NISSAN	280ZX 2+2	105	105	-	-
PONTIAC	FIREBIRD	-	-	106	102
TOYOTA	CELICA SUPRA	-	-	97	100

(See notes on Page 6)

Table 1 (Cont'd)
Relative Injury Claim Frequency by Model Year for 1981-1983 Passenger Cars*

MAKE	SERIES	MODEL YEAR** 1981	1982a	1982b	1983
LARGE CARS					
TWO-DOOR MODELS					
BUICK	LE SABRE	85	74	69	70
OLDSMOBILE	DELTA 88	69	71	70	71
FOUR-DOOR MODELS					
BUICK	ELECTRA	67	73	73	64
BUICK	LE SABRE	65	60	63	62
CHEVROLET	CAPRICE	83	63	72	66
CHEVROLET	IMPALA	73	79	79	77
CHRYSLER	NEW YORKER 5TH AVE	—	—	72	67
FORD	CROWN VICTORIA	73	69	75	65
MERCURY	GRAND MARQUIS	80	56	67	66
OLDSMOBILE	DELTA 88	59	58	58	57
OLDSMOBILE	NINETY-EIGHT	57	64	63	63
STATION WAGONS/PASSENGER VANS					
CHEVROLET	CAPRICE	65	73	77	64
OLDSMOBILE	CUSTOM CRUISER	—	—	53	57
SPORTS & SPECIALTY					
BUICK	RIVIERA	78	63	70	80
CADILLAC	BROUGHAM 4D	77	83	82	61
CADILLAC	DE VILLE 2D	87	79	78	85
CADILLAC	DE VILLE 4D	66	68	65	69
CADILLAC	ELDORADO	88	66	68	76
CADILLAC	SEVILLE	—	—	63	83
LINCOLN	TOWN CAR	68	81	73	70
MERCEDES	300D	—	—	63	66
OLDSMOBILE	TORONADO	69	62	67	61

* Results Standardized to the Distribution:

Youthful Operator - 10%
No-Youthful Operator - 90%

** 1981 and 1982a results were based on data used in HLDI Report I83-1;
1982b and 1983 results were based on data used in HLDI Report I84-1.

A dash (–) indicates insufficient exposure for model year or substantial change in design occurred precluding comparison of results.

APPENDIX A

Confidence Intervals for Relative Strandardized Claim Frequency

This appendix summarizes the approach used to construct confidence intervals for individual model year relative claim frequencies for those vehicles satisfying the exposure requirements of this study. Confidence intervals were initially constructed for the standardized claim frequency and were subsequently converted to correspond to the vehicle's model year relative claim frequency.

The standardized claim frequency (CF) per 1,000 insured vehicle years is given by the equation:

$$CF = 1{,}000\ [(.1)\ N_1/E_1 + (.9)\ N_2/E_2],$$

where N_1 = Total number of claims for the youthful operator age group;

N_2 = Total number of claims for the no-youthful operator age group;

E_1 = Exposure in insured vehicle years for the youthful operator age group; and

E_2 = Exposure in insured vehicle years for the no-youthful operator age group.

For each operator age group, the distribution of the number of claims, N_i, can be satisfactorily approximated by a Poisson distribution with mean and variance (L_iE_i), where

L_i = claim frequency (per insured vehicle year) for the operator age group,

$= N_i/E_i$.

The variance of CF is then

$$VAR(CF) = (1{,}000)^2\ [(.1)^2\ N_1/E_1^2 + (.9)^2\ N_2/E_2^2].$$

For the exposure requirements used in this report, the distribution of the standardized claim frequency can be satisfactorily approximated by a normal distribution with mean CF and variance VAR(CF). A two-sided 95 percent confidence interval for the standardized claim frequency is then given by the expression

$$CF \pm 1.96\sqrt{VAR(CF)}.$$

For a specific model year, a vehicle's standardized claim frequency (CF) is converted to a relative claim frequency (RCF) by dividing the standardized result by the model year's standardized claim frequency for all passenger cars. Thus, *each* vehicle's standardized model year claim frequency result is divided by a constant value (K), which is the particular model year's all-passenger-car result. That is, RCF = CF/K and VAR(RCF) = VAR(CF)/K^2, where the all-passenger-car results were 17.1 for model year 1981; 18.2 and 17.5 for the two sets of model year 1982 results; and 18.9 for the model year 1983 results. Therefore, a vehicle's model year standardized claim frequency and its associated confidence interval endpoints are converted to relative values by dividing by the appropriate all-passenger-car model year result.

Example:

For personal injury protection (PIP) coverage, the results for the 1981 Dodge Colt two-door models were as follows:

Operator Age Group	Exposure in Insured Vehicle Years	Number of Claims
Youthful	3,636	142
No-Youthful	16,360	378

Thus, the standardized claim frequency is

$$CF = 1{,}000\ [(.1)\ 142/3{,}636 + (.9)\ 378/16{,}360]$$
$$= 24.7 \text{ claims per } 1{,}000 \text{ insured vehicle years of exposure,}$$

and its variance is

$$VAR(CF) = (1{,}000)^2\ [(.1)^2\ 142/3{,}636^2 + (.9)^2\ 378/16{,}360^2]$$
$$= 1.3.$$

Thus, the 95 percent confidence interval for the standardized claim frequency is

$$CF \pm 1.96\sqrt{VAR(CF)} = (22.5,\ 26.9).$$

The all-passenger-car result for model year 1981 was 17.1; therefore, the relative claim frequency is $(24.7/17.1) \cdot 100 = 144$. The endpoints of the confidence interval for the standardized claim frequency are converted to relative values by also dividing each of the values by the all-passenger-car result:

$(22.5/17.1) \cdot 100 = 132$ and $(26.9/17.1) \cdot 100 = 157$.

APPENDIX B
Definitions

Claim Frequency - The number of claims for a group of vehicles, divided by the exposure for that group; expressed as claims per one thousand insured vehicle years.

Exposure - The time interval an individual vehicle is insured. Exposure for a group of vehicles is expressed in units of insured vehicle years.

First-Party Coverage - An insurance coverage under which the policyholder collects compensation for his losses from his own insurer regardless of fault.

No-Fault Auto Insurance - An auto insurance plan in which each driver/owner accepts financial responsibility for some or all losses sustained by himself, pedestrians hit by him, and occupants of his own vehicle in return for which he enjoys some immunity from liability for losses to third party persons.

Operator Age Group - The factor that distinguishes those vehicles with a youthful rated driver from those vehicles without a youthful rated driver (see Youthful Operator).

Personal Injury Protection (PIP) Coverage - First party no fault coverage in which an insurer pays, within the specified limits, the medical, hospital, and other expenses of the insured, others in his vehicle, and pedestrians struck by him.

Rated Driver - The driver who, for insurance purposes, is considered to represent the greatest loss potential for the insured vehicle.

Passenger Car Classifications - There are four major body style groupings of passenger cars—regular two door models, regular four door models, station wagons and passenger vans, and sports and specialty models. Sports and specialty models include all two seater cars, all convertibles, all midsize and large cars with two or fewer designated rear seating positions, and all luxury cars. Each body style group is further divided into classes based on wheelbase size (rounded to the nearest inch) defined as follows:

Small - Cars with wheelbases less than or equal to 99 inches.

Midsize - Cars with wheelbases greater than 99 inches less than or equal to 109 inches.

Large - Vehicles with wheelbases greater than 109 inches.

Vehicle Series - A name denoting a family of vehicles, within a make, with the same wheelbase and a degree of commonality in construction such as body, chassis, etc.

Youthful Operator - For the purposes of this report, all males (married or single) under 25 years of age and all unmarried females under 25 years of age.

HLDI Publications

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A-10 *Automobile Insurance Losses, Injury Coverages; Comparisons of Claim Frequencies of Volkswagen Rabbits with Automatic and Manual Seat Belts, 1975, 1976, and 1977 Models,* June 1979.

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A-12 *Automobile Insurance Losses, Collision Coverages; An Assessment of the Effects of the Federal Safety Bumper Standard on the Losses for 1972 Through 1978 Models,* June 1980.

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T84-1 *Insurance Losses, Theft Coverages; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1984 Models During Their First Year, 1983 Models During Their First Two Years, 1982 Models During Their First Three Years,* March 1985.

T85-1 *Insurance Theft Report; Passenger Cars, Vans, Pickups, and Utility Vehicles; 1985 Models During Their First Year, 1984 Models During Their First Two Years, 1983 Models During Their First Three Years,* April 1986.

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INSURANCE SPECIAL REPORT
A Preliminary Evaluation of New York and New Jersey Insurance Injury Claim Results Before and After Enactment of Mandatory Seat Belt Legislation, 1983-85 Models

Highway Loss Data Institute

A-27

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Insurance Special Report

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HLDI A-27

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SUMMARY

New York and New Jersey were among the first states to enact legislation requiring front seat occupants of passenger cars to wear seat belts. This Highway Loss Data Institute (HLDI) report presents preliminary results only on the frequency of insurance claims for injuries to occupants of 1983-85 model year vehicles before and after these states enacted seat belt statutes; it does not address the cost of the injury claims. To assess the effect of the legislation on insurance claims, post-law results for New York and New Jersey are compared to pre-law results for the same period one year earlier, and to results for Connecticut, which did not have a belt use law during the periods covered in this report. The injury results for the first nine months following implementation of the New York law (January 1, 1985 through September 30, 1985) are compared to the injury results for the corresponding nine-month period one year earlier (January 1, 1984 through September 30, 1984). Because New Jersey's statute became effective on March 1, 1985, the pre-law and post-law comparisons are for seven-month periods (March 1 through September 30 of 1984 and 1985, respectively). The results presented in this report are based on personal injury protection and collision insurance coverage losses reported for these periods.

Principal Findings:

- After implementation of seat belt use laws, both New York and New Jersey had overall injury claim frequency results for relatively new cars (model years 1983-85) that were lower than those before the laws were enacted. The decline in claims for injuries more likely to have resulted from frontal impact crashes was slightly greater than the overall decline in injury claims. During the same periods, Connecticut, which had no concurrent seat belt law, had slightly increasing overall injury claim frequencies.

- The frequencies and costs of collision coverage claims were essentially the same in each of the three states (New York, New Jersey, and Connecticut) before and after seat belt laws were passed in New York and New Jersey. Thus, the declines in injury claim frequencies for New York and New Jersey are not the result of corresponding decreases in collision claims.

- Comparison of quarterly claim frequency results for New York and New Jersey with those for Connecticut suggests that the effect of the seat belt laws on injury results was greatest in the initial periods following enactment of the laws.

INTRODUCTION

The Highway Loss Data Institute (HLDI) is a nonprofit, public service organization that gathers, processes, and publishes insurance data concerning the human and economic losses associated with motor vehicles — especially the ways such losses vary among different kinds of vehicles.

New York passed the first state law requiring the use of seat belts by all front seat occupants of passenger cars in July of 1984; enforcement of the law began January 1, 1985. New Jersey quickly followed New York's action with a law requiring belt use by front seat occupants beginning March 1, 1985. The stronger New York law specifies a maximum $50 fine compared to a $20 fine under New Jersey's law. In addition, New York's statute permits police to stop motorists solely on the basis of belt use law violations. Under New Jersey law, police are not permitted to cite violators unless they have been stopped for some other traffic violation.

This HLDI report presents results on the frequency of injury claims* to occupants of relatively new cars (1983-85 model years) before and after New York and New Jersey enacted their mandatory seat belt use laws; it does not address the cost of the injury claims. Results are also presented for Connecticut, which did not have a seat belt use law in effect during the period covered in this report. (Connecticut has since passed a law providing for a $15 fine for failure to wear seat belts after February 1986.) Connecticut was chosen as a comparison state because of its geographic closeness to New York and New Jersey, and because all three states have no-fault automobile insurance laws.

Several other states have recently passed seat belt use laws; however, there has not yet been sufficient experience with these laws to provide meaningful comparisons of their insurance loss results. Even the results presented in this report should be considered preliminary because they are based on relatively short periods following enactment of the laws and injury claims for only relatively new cars. Compliance with seat belt laws is usually higher during the initial months of implementation because of increased publicity and public awareness; therefore, a more thorough assessment of the laws' effects can only be made as insurance claims information from additional states over longer periods become available.[1]

The results in this report are based on personal injury protection and collision coverage loss data supplied by 13 insurers: Aetna, Allstate, Firemen's Fund, GEICO, Kemper, Liberty Mutual, Nationwide, Prudential, Safeco, Sentry, State Farm, Travelers, and USAA.

RESULTS AND DISCUSSION

For the analyses performed in this study, only loss results of 1983-85 model year passenger vehicles with both personal injury protection and collision coverage simultaneously in effect were used. Table 1 presents overall injury claim frequencies** for New York, New Jersey, and Connecticut. For each state, the injury claims are summarized separately for pre-law and post-law periods. For New York, the pre-law period covers January to September 1984 and the post-law period covers January to September 1985. Because New Jersey's statute did not become effective until March 1985, its pre-law period covers March through September 1984 and its post-law period covers March to September 1985. The Connecticut results are given both for the nine-month New York periods and for the seven-month New Jersey periods. For each of the states, pre-law results include 1983 and 1984 models and the post-law results include 1983, 1984, and 1985 models. For New York, the pre-law results are based on just over 300,000 insured vehicle years of exposure and the post-law results are based on just over 500,000 insured vehicle years. New Jersey's pre-law results are based on approx-

TABLE 1 Frequency of Injury Claims, Model Years 1983-85

State	Claim Frequency Per 1,000 Insured Vehicle Years: Before Law	After Law	Percent Change
New York	20.8	19.8	–5%
Connecticut	19.1	19.3	+1%
New Jersey	22.3	20.7	–7%
Connecticut	19.0	19.2	+1%

Note: New York's before-law and after-law periods are January through September of 1984 and 1985, respectively; New Jersey's before-law and after-law periods are March through September of 1984 and 1985, respectively; Connecticut's comparison periods correspond to those of New York or New Jersey.

*In calculating injury claim frequencies, all injuries in a crash-involved car resulting in claims for medical expenses made under personal injury protection insurance coverages are counted as a single claim. A description of these first-party coverages, which principally insure against medical losses to occupants of the insured cars themselves, is given in Appendix B.

**These results are standardized to insure the same mix of exposure from youthful and no-youthful operators. For a more detailed discussion of standardization, see Appendix A.

TABLE 2 Summary of Collision Coverage Losses, Model Years 1983-85

State	Claim Frequencies Per 100 Insured Vehicle Years		Average Loss Payment Per Claim		Average Loss Payment Per Insured Vehicle Year	
	Before Law	After Law	Before Law	After Law	Before Law	After Law
New York	11.7	11.9	$1,615	$1,628	$189	$194
Connecticut	10.0	10.3	$1,720	$1,732	$172	$178
New Jersey	10.7	11.1	$1,642	$1,710	$176	$190
Connecticut	9.7	9.7	$1,721	$1,726	$167	$167

Note: New York's before-law and after-law periods are January through September of 1984 and 1985, respectively; New Jersey's before-law and after-law periods are March through September of 1984 and 1985, respectively; Connecticut's comparison periods correspond to those of New York or New Jersey.

imately 92,000 insured vehicle years of exposure and the post-law results are based on approximately 156,000 vehicle years. For the comparison with New York, Connecticut results are based on approximately 70,000 insured vehicle years for the pre-law period and 110,000 insured vehicle years for the period after New York's law. For the comparison with New Jersey, the corresponding pre-law and post-law Connecticut exposures for the seven-month periods are approximately 59,000 and 89,000 insured vehicle years, respectively.

For all personal injury protection claims, New York's pre-law claim frequency of 20.8 claims per 1,000 insured vehicle years declined by five percent to 19.8 claims during the first nine months of its mandatory seat belt law; whereas claim frequency in Connecticut, with no concurrent seat belt law, increased by one percent. Similarly, New Jersey's injury claim frequency dropped by seven percent during the seven months following enactment of its seat belt law compared to a one percent increase in Connecticut. It is also interesting to note that an analysis comparing crash fatalities during the first nine months of New York's law with those of neighboring states without a law showed a reduction of approximately nine percent in New York.[2]

Because it was possible that the post-law reductions in injury claim frequencies in New York and New Jersey simply reflected reduced levels of collision involvement during the post-law periods, the collision loss results for the two periods in each of the states were compared. Table 2 presents a summary of the frequency and cost of collision claims* in New York, New Jersey, and Connecticut during the pre-law and post-law periods of interest. The frequencies and costs of collision coverage claims were essentially the same in each of the three states before and after seat belt laws were passed in New York and New Jersey. Thus, the declines in injury claim frequencies for New York and New Jersey are not the result of corresponding decreases in collision claims.

The injury claims used to calculate the frequencies presented in Table 1 may or may not also have an associated collision coverage claim. In the overwhelming majority of crashes with injury claims, there is vehicle damage even when there is no collision claim. In cases where there is no collision coverage claim for the same crash, the collision damage costs are recovered through a property damage liability claim from the insurer of other involved vehicles that were at fault; they are below the collision deductible amount; or they are not being recovered through automobile insurance. Collision coverage claims often are for the vehicle at fault. Consequently, they tend to be dominated by front-end damage, whereas, property damage liability claims are for the vehicle not at fault and they are dominated by rear-end damage. Thus, injury claims with associated collision coverage claims are more likely to be from frontal crashes, and injuries with no associated collision coverage claims are more likely to be from rear-end crashes. A previous HLDI report (A-21), which compared injury claim frequencies for 1981-82 Volkswagen Rabbits with automatic belts versus manual belts, presented results that suggested belt systems have a greater effect on injury claims resulting from crashes more likely to be frontal impacts. Therefore, to the extent that the injury claims with no associated collision coverage claim are more likely to be injuries such as whiplash resulting from rear-end impacts, increases in belt use in states with mandatory

*Collision results were standardized to eliminate effects due to operator age group and deductible amounts. See Appendix A for standardization weights.

belt use laws should influence the frequency of such injuries less than injuries in frontal crashes where belts are more effective.

Because of the implicit differences between injury claims with and without associated collision claims, Table 3 presents claim frequencies only for injury claims with associated collision coverage claims (i.e., claims more likely to result from frontal impacts). For these injuries, New York's pre-law frequency of 14.8 claims declined to 13.8 claims after enactment of the mandatory seat belt law—a seven percent decrease. In contrast, after passage of the New York law, the Connecticut results show a one percent increase. Similarly, New Jersey's post-law claim frequency decreased from its pre-law level. For those claims more likely to be from frontal impact crashes, the results in New Jersey fell from 13.2 claims to 12.1 claims—an eight percent decline. Comparable results for Connecticut indicate a decline of only two percent. Thus, for those crashes more likely to be frontal impacts (in which seat belts are most effective), both New York's and New Jersey's claim frequency results decreased after implementation of the law, whereas Connecticut's showed little change. Also, it is interesting to note that the declines in claim frequency in New York and New Jersey for injuries more likely to have resulted from frontal impacts are slightly more pronounced than those for all injuries presented in Table 1.

TABLE 3 Frequency of Injury Claims With Associated Collision Claims, Model Years 1983-85

	Claim Frequency Per 1,000 Insured Vehicle Years		
State	Before Law	After Law	Percent Change
New York	14.8	13.8	-7%
Connecticut	9.9	10.0	+1%
New Jersey	13.2	12.1	-8%
Connecticut	9.9	9.7	-2%

Note: New York's before-law and after-law periods are January through September of 1984 and 1985, respectively; New Jersey's before-law and after-law periods are March through September of 1984 and 1985, respectively; Connecticut's comparison periods correspond to those of New York or New Jersey.

Quarterly Pre-Law and Post-Law Comparisons

Studies of seat belt usage rates in states with mandatory use laws have shown that compliance with the laws generally decreases with time. The Insurance Institute for Highway Safety has conducted observational surveys of shoulder belt use compliance in a number of large urban areas, small cities, and intercity areas of New York and New Jersey.[1] For each state, belt use was observed several months before the law went into effect and during the first month of enforcement. Belt use compliance in New York was also observed during April and August of 1985, and one year after enactment of the law, January 1986. For areas of New Jersey, belt use compliance was also observed in the fifth month of the law, July 1985. For the selected study areas of New York and New Jersey, Tables 4 and 5 present shoulder belt use rates for passenger car drivers and right front passengers combined. For both of the states, large initial increases in belt use were observed over the pre-law levels. In New York, compliance was generally stable for the first and fourth months of the law — January and April of 1985. However, surveys conducted in August 1985 and January 1986 showed, for the most part, much lower levels of compliance in comparison to the January and April 1985 survey results. Although the seat belt law was still relatively new in July 1985, several of the New Jersey areas surveyed during that time showed much lower usage rates in comparison to March 1985 survey results.

To determine whether the injury results for New York and New Jersey show a corresponding decline in benefits, the claim frequency results for injury claims with associated collision coverage claims were examined by calendar quarter. Table 6 presents the quarterly pre-law and post-law results for New York and New Jersey relative to the results for Connecticut. Thus, for example, New York's pre-law relative claim frequency of 152 for the first quarter indicates that its standardized claim frequency is approximately 50 percent greater than Connecticut's result of 10.4.

Based on the pre-law results in Table 6, injury claim frequencies in the absence of seat belt legislation were approximately 50 percent higher in New York than Connecticut. However, after enactment of New York's seat belt law, its claim frequencies ranged from only 35 to 41 percent higher than Connecticut's. The largest decrease in New York's relative results occurred in the first quarter—an 11 percent decline. Decreases for the next two quarters are smaller. Relative quarterly results for New Jersey also show decreases in each quarter following enactment of the seat belt law, but the largest decrease in New Jersey's relative results occurs in the

TABLE 4 Percentage Shoulder Belt Use by Car Drivers and Right Front-Seat Passengers* in New York State

	Pre-Law	Post-Law			
	September 1984	January 1985	April 1985	August 1985	January 1986
Large Urban Areas					
Albany	12	50	52	—	42
Buffalo	12	68	66	47	41
Nassau/Queens	11	49	49	39	38
Westchester/Bronx	15	57	61	—	46
Syracuse	18	81	70	49	54
Small Cities					
Elmira	14	62	52	—	65
Glens Falls	11	55	47	45	42
Jamestown	8	48	48	—	37
Rome	14	60	51	44	38
Watertown	14	43	43	40	39
Intercity	30	76	66	—	61

*Passengers estimated to be under seven years old excluded

Source: Williams, A., Wells, J., and Lund, A. Shoulder Belt Use in Four States With Belt Use Laws. Insurance Institute for Highway Safety, Washington, D.C., 1986.

second quarter—a nine percent decline. The smaller difference in the first quarter results for New Jersey may be due to New Jersey's seat belt law being effective for only one month during that quarter.

Although these results are preliminary, larger reductions in insurance injury claims generally occurred in the periods immediately following enactment of the seat belt laws. This suggests that the reductions in insurance injury claims were smaller as seat belt use declined.

Proportions of Collision Claims With Injury Claims

Table 7 presents New York and Connecticut's pre-law and post-law proportions of all collision coverage claims that have associated personal injury protection claims by amount of collision damage. Collision damage was determined by adding the collision deductible to the paid claim amount. Except for damage between $1 and $1,000, New York's post-law proportions are consistently lower than its pre-law proportions. Differences in New York's pre-law and post-law results are smallest for the high and low ends of the collision damage amount groups. Corresponding pre-law and post-law proportions for Connecticut during the same nine-month period show both increases and decreases within the collision damage groups. However, for each collision amount group New York's percentage changes generally indicate larger decreases or smaller increases between its before-law and after-law results compared to Connecticut's corresponding percentage change results.

A similar presentation is made in Table 8 for New Jersey and Connecticut. The pre-law and post-law results of both states are again based on seven-month periods. Except for collision damage between $2,001 and $3,000, New Jersey's post-law proportions were consistently lower than its pre-law results. Again, with the exception of collision damage between $2,001 and $3,000, New Jersey's percentage changes generally indicate more of an improvement between the pre-law and post-law results than is observed in the Connecticut results.

The preliminary results presented in Tables 1 through 8 indicate that mandatory seat belt legislation can lead to reductions in the frequency of insurance injury claims.

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TABLE 5 Percentage Shoulder Belt Use by Car Drivers and Right Front-Seat Passengers* in New Jersey

	Pre-Law	Post-Law	
	November 1984	March 1985	July 1985
Large Urban Areas			
Paramus	17	41	48
Hackensack	16	58	47
Passaic/Patterson	13	58	47
Montclair/Bloomfield	16	61	43
Oranges/Newark	24	56	53
Jersey City	15	55	52
Union	20	62	52
Elizabeth/Linden	14	54	46
Trenton	11	41	36
Camden	20	38	36
Small Cities			
Atlantic City	9	25	19
Vineland	8	33	23
Intercity	—	—	54

*Passengers estimated to be under seven years old excluded

Source: Williams A., Wells, J., and Lund, A. Shoulder Belt Use in Four States with Belt Use Laws, Insurance Institute for Highway Safety, Washington, D.C., 1986.

TABLE 6 Injury Claim Frequencies* by Calendar Quarter, Model Years 1983-85

Calendar Year Quarter	New York Quarterly Relative Claim Frequency**	New Jersey Quarterly Relative Claim Frequency**	Connecticut Quarterly Claim Frequency Per 1,000 Insured Vehicle Years
1st Quarter			
Before Law	152	124	10.4
After Law	135	120***	10.1
Percent Change	*-11%*	*-3%*	
2nd Quarter			
Before Law	148	140	10.1
After Law	140	127	9.8
Percent Change	*-5%*	*-9%*	
3rd Quarter			
Before Law	151	126	9.5
After Law	141	119	10.1
Percent Change	*-7%*	*-6%*	

*Based on injury claims with associated collision claims only.

**Quarterly results for New York and New Jersey are expressed relative to Connecticut's quarterly results.

***NOTE: This quarterly claim frequency for New Jersey is based on one month of results following enactment of the law (March 1985) and two months of results prior to enactment (January and February 1985).

TABLE 7 Comparison of New York and Connecticut Collision Coverage Claims With Associated Personal Injury Protection Claims, Model Years 1983-85

Collision Damage Amount	Seat Belt Law*	New York		Connecticut	
		No. of Collision Claims	Proportion of Collision Claims With Injury Claim	No. of Collision Claims	Proportion of Collision Claims With Injury Claim
$1–$1000	Before	14,964	0.029	2,924	0.022
	After	24,146	0.030	4,611	0.023
	Percent Change		*+3.4%*		*+4.5%*
$1001–$2000	Before	8,685	0.080	1,570	0.054
	After	14,588	0.071	2,574	0.057
	Percent Change		*–11.3%*		*+5.6%*
$2001–$3000	Before	3,903	0.181	668	0.145
	After	6,761	0.152	1,220	0.125
	Percent Change		*–16.0%*		*–13.8%*
$3001–$4000	Before	2,105	0.267	384	0.211
	After	3,894	0.234	666	0.209
	Percent Change		*–12.4%*		*–0.9%*
$4001–$6000	Before	2,150	0.390	408	0.341
	After	3,707	0.356	638	0.317
	Percent Change		*–8.7%*		*–7.0%*
>$6000	Before	2,427	0.509	498	0.504
	After	3,913	0.489	781	0.524
	Percent Change		*–3.9%*		*+4.0%*

*Before-law results are based on nine-month period of January 1 through September 30, 1984. After-law results are based on nine month period from January 1 through September 30, 1985. Connecticut did not have a seat belt law during these periods.

TABLE 8 Comparison of New Jersey and Connecticut Collision Coverage Claims With Associated Personal Injury Protection Claims, Model Years 1983-85

Collision Damage Amount	Seat Belt Law*	New Jersey		Connecticut	
		No. of Collision Claims	Proportion of Collision Claims With Injury Claim	No. of Collision Claims	Proportion of Collision Claims With Injury Claim
$1–$1000	Before	4,131	0.035	2,399	0.023
	After	6,646	0.033	3,534	0.024
	Percent Change		*–5.7%*		*+4.3%*
$1001–$2000	Before	2,316	0.087	1,290	0.053
	After	3,689	0.073	1,916	0.056
	Percent Change		*–16.1%*		*+5.7%*
$2001–$3000	Before	981	0.173	542	0.157
	After	1,680	0.180	899	0.133
	Percent Change		*+4.0%*		*–15.3%*
$3001–$4000	Before	546	0.326	314	0.204
	After	940	0.246	488	0.227
	Percent Change		*–24.5%*		*+11.3%*
$4001–$6000	Before	485	0.404	330	0.342
	After	890	0.384	459	0.336
	Percent Change		*–5.0%*		*–1.8%*
>$6000	Before	512	0.621	420	0.526
	After	901	0.552	597	0.536
	Percent Change		*–11.1%*		*+1.9%*

*Before-law results are based on seven-month period of March 1 through September 30, 1984. After-law results are based on seven-month period from March 1 through September 30, 1985. Connecticut did not have a seat belt law during these periods.

APPENDIX A Standardization

Insurance loss experience varies in relation to certain nonvehicle factors. With respect to Personal Injury Protection (PIP) coverages, one important factor that influences loss experience is operator age. Youthful operators generally have worse loss experience than older drivers. Thus, the proportions of youthful operators must be taken into consideration in comparing the loss experience of different vehicles.

To remove any biases that could result because of variations among different vehicles in an operator age group, the PIP coverage results for the vehicles in this study were weighted, or standardized, to produce a weighted average of actual results. The weights used in the standardization procedure are shown below.

Operator Age Group	Distribution
Youthful	.10
No Youthful	.90

With respect to collision coverages, both the frequency and average size of collision losses vary with the deductible amount and the age group of the operators. Therefore, collision coverage results for the vehicles in this study were standardized using the weights shown below.

Deductible	Youthful Operator	No Youthful Operator
< $150	.05	.50
≥ $150	.05	.40

Standardizing on these nonvehicle factors ensures that the mix is the same for each result. Therefore, to the extent that age distributions within each operator age group and amounts within each deductible group do not vary substantially for different vehicles, these effects will not bias comparisons among the various results.

The standardization procedure employed is widely used in health statistics.* The basic principle of the method is the introduction of a selected population with a standard distribution across operator age group or across the combination of operator age group and deductibles, as represented by the standardization weights in the tables.

*For example, see Armitage, P. *Statistical Methods in Medical Research*. Wiley, New York (1971).

APPENDIX B Definitions

Definitions Average Loss Payment Per Claim — The total of all loss payments made for the claims for a group of vehicles, divided by the number of claims paid, expressed as dollars per claim.

Average Loss Payment Per Insured Vehicle Year — For a group of vehicles, the product of claim frequency and average loss payments per claim, divided by 100; expressed as dollars per insured vehicle year. It should be noted that this definition differs from the commonly used insurance term pure premium, but yields similar results.

Collision Claim Frequency — The number of claims for a group of vehicles, divided by the exposure for that group; expressed as claims per one hundred insured vehicle years.

Collision Coverages — As defined in insurance contracts, the coverage under which people insure their own vehicle against loss caused by collision.

Deductible Amount — That portion of the collision damage cost borne by the policyholder. For computing results, deductible amounts are split into two groups; less than $150 (mainly $50 and $100 deductibles) and greater than or equal to $150 (mainly $200 and $250 deductibles).

Exposure — The time interval an individual vehicle is insured. Exposure for a group of vehicles is expressed in units of insured vehicle years.

Personal Injury Protection (PIP) Claim Frequency — The number of claims for a group of vehicles, divided by the exposure for that group; expressed as claims per one thousand insured vehicle years.

Personal Injury Protection Coverage — First-party no-fault coverage in which an insurer pays, within the specified limits, the medical, hospital, and other expenses of the insured, others in his vehicle, and pedestrians struck by him.

Operator Age Group — The factor that distinguishes those vehicles whose rated driver is youthful from those vehicles whose rated driver is not youthful (see Youthful Operator).

Rated Driver — The driver who, for insurance purposes, is considered to represent the greatest loss potential for the insured vehicle.

Youthful Operator — For the purposes of this report, all males (married or single) under 25 years of age and all unmarried females under 25 years of age.

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